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PENTRON MODELS NL-1, -1S, NL-2, -2S, NL-3, -3S, TM-1, -4

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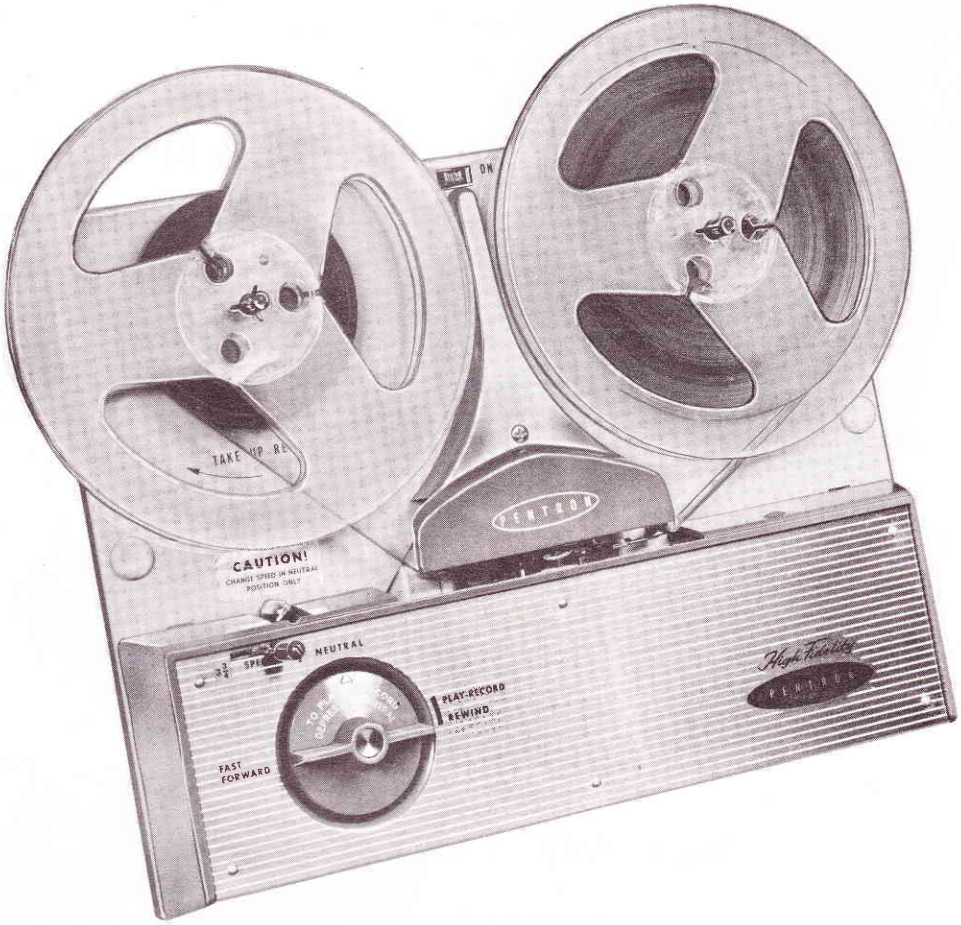

PENTRON MODELS NL-1, -1S, NL-2, -2S, NL-3, -3S, TM-1, -4

GENERAL INFORMATION

Pentron Models NL-1, NL-1S, NL-2, NL-2S, NL-3, and NL-3S are designed for making and playing back tape recordings at either 3 3/4 inches per second or 7 1/2 inches per second. Recording is dual track so that two full length recordings can be made on a single reel of tape. Any size reel up to 7" may be used on these machines and therefore a recording time of 3 hours or more can be had, depending upon the tape thickness.

Models TM-1 and TM-4 are identical except for the sterophonic heads used in Model TM-4.

These Models are for operation on a 60 cycle 105 to 120 volts, AC supply only. Before connecting to your line supply, make certain that it agrees with the above specifications.

Manufactured by :

Pentron Corporation
777 South Tripp Avenue
Chicago 24, Illinois

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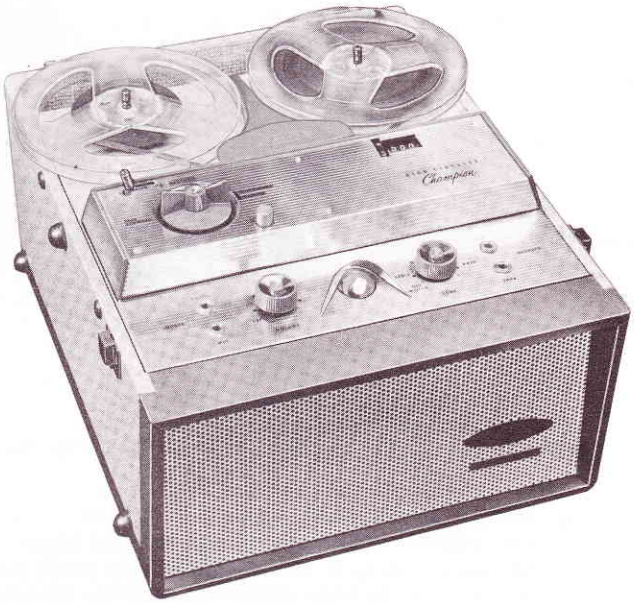
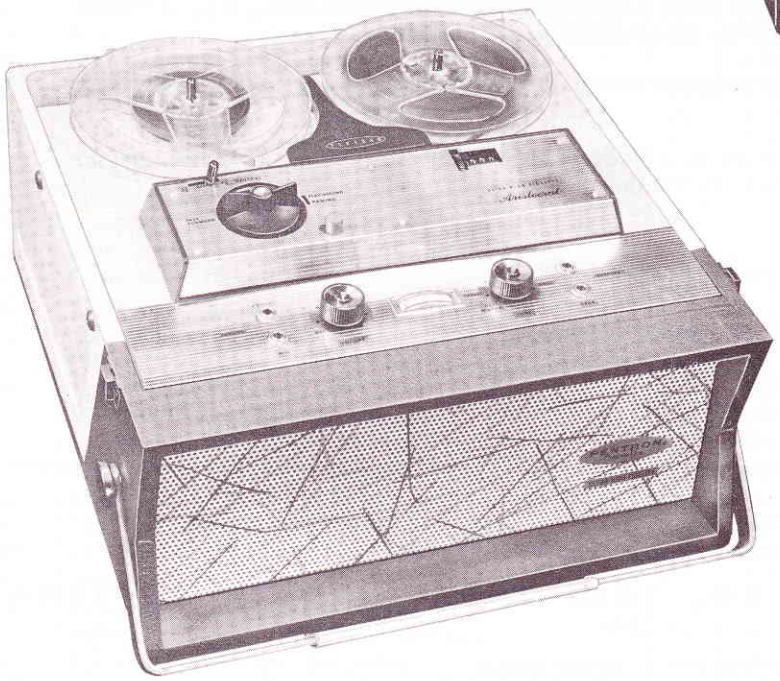
SET 414 FOLDER 7

MODEL NL-1



MODEL NL-2



MODEL NL-3

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SPECIFICATIONS

TM-1 Transport Mechanism

SPEEDS: Record and playback, 7 1/2 and 3 3/4 ips.
FAST FORWARD: Complete wind of a 7 inch reel in 75 seconds.
REWIND: Complete rewind of a 7 inch reel in 90 seconds.
FLUTTER: Under 0.4% at 7 1/2 ips.
Under 1 % at 3 3/4 ips.
MOTOR: Heavy duty 4 pole, shaded pole motor, dynamically and individually balanced.
CONTROL: Single rotary control for Play, Record, Fast Forward, and Rewind.

TM-4 Transport Mechanism

The TM-4 mechanism is the same as TM-1 except that it uses a stacked "stereo" head assembly.

NL-1 Recorder

FREQUENCY RESPONSE: 40 to 11,000 cps at 7 1/2 ips; 40 to 7,000 cps at 3 3/4 ips.
POWER OUTPUT: 4 watts.
SIGNAL TO NOISE RATIO: 45 db.
"RECORD-PLAYBACK HEAD" AND DOUBLE GAP ERASE HEAD: Have replaceable pole pieces.
RECORD LEVEL INDICATOR: Neon type.
INPUT JACKS: One for microphone or magnetic phono cartridge; one for radio, TV, and crystal or ceramic phono cartridge.
OUTPUT JACKS: One for external amplifier or headphone monitoring; one for external speaker.
TUBE COMPLEMENT: One each 6J7, 6SL7, 6X5, and 6V6.
POWER CONSUMPTION: 70 watts, full load.
DIMENSIONS: 14"W x 17"D x 11"H.
WEIGHT: 25 lbs.

Mechanical Specifications are the same as for TM-1 as mentioned above.

NL-1S Recorder

The NL-1S is the same as Model NL-1 except that it uses a stacked "stereo" head assembly and a "stereo" preamplifier.

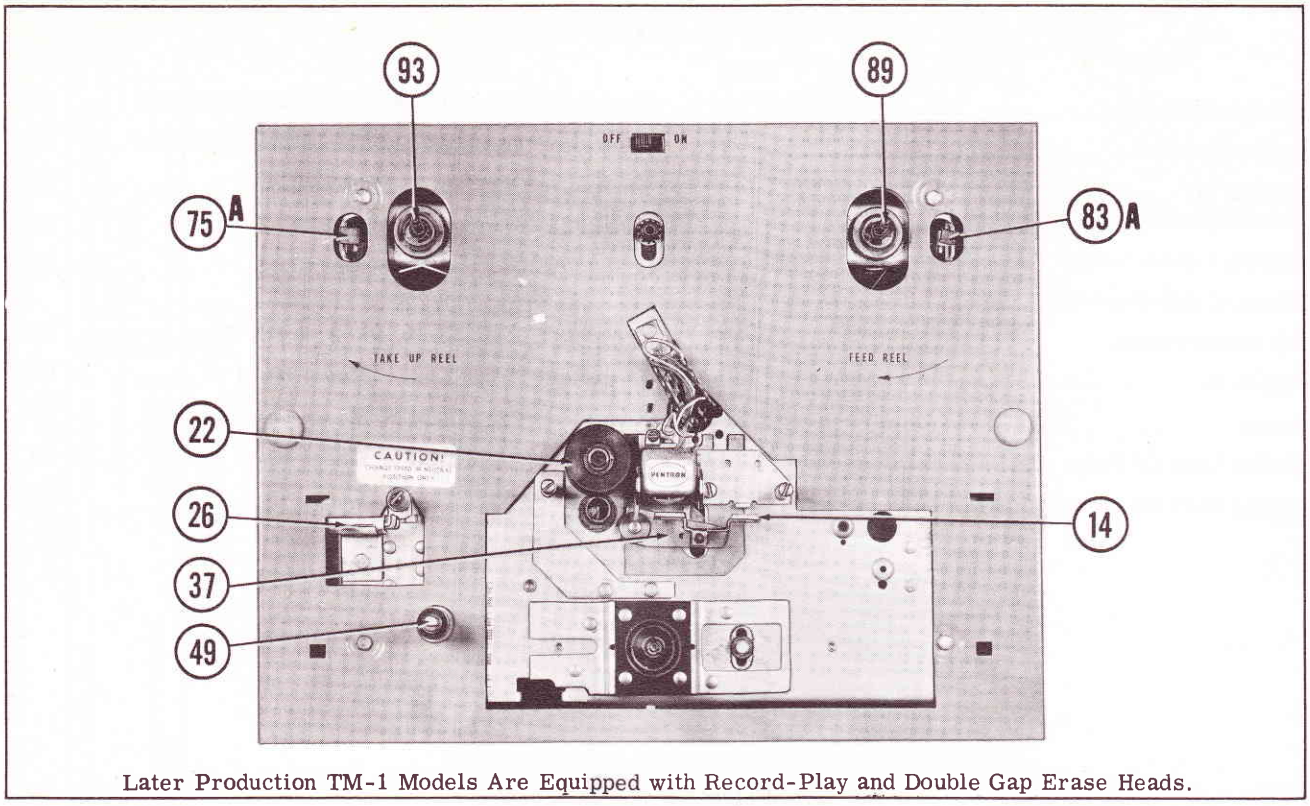
NL-2 Recorder

FREQUENCY RESPONSE: 40 to 13,000 cps at 7 1/2 ips; 40 to 7,000 cps at 3 3/4 ips.
POWER OUTPUT: 5 watts.
SIGNAL TO NOISE RATIO: 48 db.
"RECORD-PLAYBACK HEAD" AND DOUBLE GAP ERASE HEAD: Have replaceable pole pieces.
RECORD LEVEL INDICATOR: Magic eye.
AUTOMATIC INDEX COUNTER.
INPUT JACKS: One for microphone or magnetic phono cartridge; one for radio, TV, and crystal or ceramic phono cartridge.
OUTPUT JACKS: One for external amplifier or headphone monitoring; one for external speaker.
TUBE COMPLEMENT: One each 6J7, 6SL7, 6X5, 6V6, and 6E5.
POWER CONSUMPTION: 80 watts, full load.
DIMENSIONS: 14"W x 16 3/4"D x 10 3/4"H.
WEIGHT: 29 lbs.

Mechanical Specifications are the same as for TM-1, as mentioned above.

NL-2S Recorder

The NL-2S is the same as Model NL-2 except that it uses a stacked "stereo" head assembly and a "stereo" preamplifier.



Later Production TM-1 Models Are Equipped with Record-Play and Double Gap Erase Heads.

Figure 1. Top View Of TM-1 With Escutcheons Removed.

NL-3 Recorder

FREQUENCY RESPONSE: 40 to 15,000 cps at 7 1/2 ips; 40 to 7,500 cps at 3 3/4 ips.
POWER OUTPUT: 10 watts, push-pull.
SIGNAL TO NOISE RATIO: 50 db.
"RECORD-PLAYBACK HEAD" and DOUBLE GAP ERASE HEAD: Have replaceable pole pieces.
RECORD LEVEL INDICATOR: Illuminated VU meter.
AUTOMATIC INDEX COUNTER.
INPUT JACKS: One for microphone or magnetic phono cartridge; one for radio, TV, and crystal or ceramic phono cartridge.
OUTPUT JACKS: One for external amplifier or head phone monitoring; one for external speaker.
TUBE COMPLEMENT: One each 6J7, 6SL7, 6X5, 6V6, 12AU7, & two 6AQ5's.
POWER CONSUMPTION: 110 watts, full load.
DIMENSIONS: 17 1/8"W x 17 3/4"D x 11"H.
WEIGHT: 35 lbs.

NL-3S Recorder

The NL-3S is the same as Model NL-3 except that it uses a stacked "stereo" head assembly and a "stereo" preamplifier.

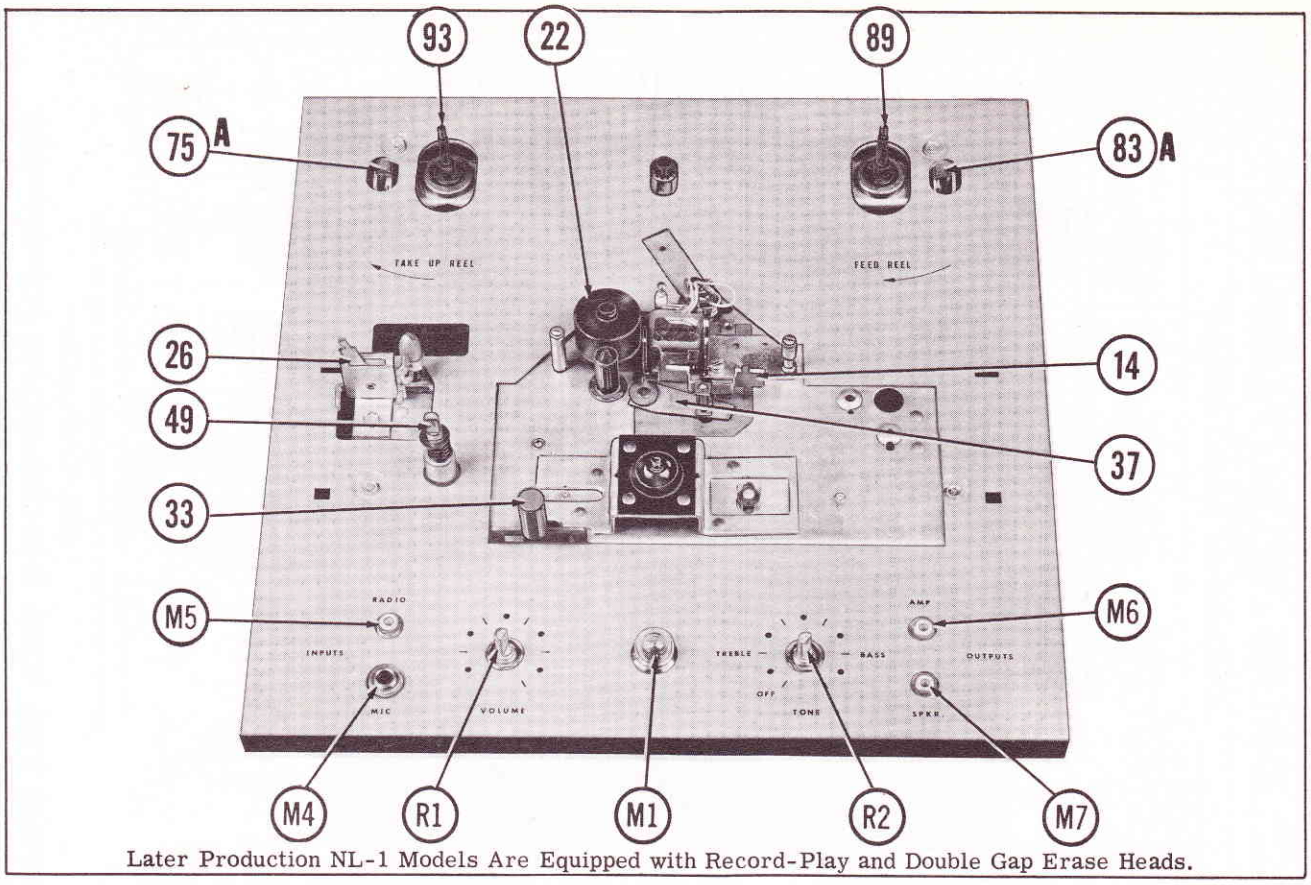
FUNCTIONS OF CONTROLS, INDICATORS, AND SWITCHES

Speed Control

Tape speed is controlled by moving the Speed Control Lever (26) either to the right or left. When the lever is in the right hand position the tape speed will be 7 1/2 ips. When it is in the left hand position the speed will be 3 3/4 ips. Change of speeds should be made only when the Rotary Control (3) is in the neutral position.

The mechanical action during a speed-change operation is as follows: A notch in the Speed Control Lever (26) engages the Speed Control Sector (25) so that when the Speed Control Lever is moved either to the left or right, the Speed Control Sector and the attached Shaft (67) or (69) are moved up or down, accordingly. The Idler Wheel (94) and Idler Bracket Sub Assembly (95) are attached to the shaft assembly and move up or down with it, thus allowing the Idler Wheel (94) to contact one or the other of the two steps on the Motor Pulley (99). When the Speed Control Lever (26) is in the left hand position the Idler Wheel (94) is in the up position and contacts the smaller step of the Motor Pulley (99). A tape speed of 3 3/4 ips results. When the Speed Control Lever (26) is in the right hand position the Idler Wheel (94) is in the down position and contacts the larger step of the Motor Pulley (99). This results in a tape speed of 7 1/2 ips.

When the Speed Control Lever (26) is moved to the right to select a tape speed of 7 1/2 ips, the downward movement of the Speed Change Shaft (69) causes the Speed Equalization Switch (M3 on Model NL-2 and M7 on Model NL-3) to open in order to obtain correct equalization for the 7 1/2 ips speed.



Later Production NL-1 Models Are Equipped with Record-Play and Double Gap Erase Heads.

Figure 2. Top View Of NL-1 With Escutcheons Removed.

Rotary Control

The Rotary Control (3) governs the mechanical operation of the transport mechanism. When the Rotary Control is turned to the left, or in a counter-clockwise direction from the neutral position, the mechanism is placed in Fast Forward operation. When the control is turned in a clockwise direction from neutral the mechanism is placed in Fast Rewind operation. To place the mechanism in Play or Record operation the Rotary Control is pressed downwards from neutral and turned to the right.

CAUTION: Do not attempt to turn the control to the left while it is depressed.

The idler wheel is automatically disengaged when the rotary control is in neutral position.

Action of the Rotary Control Shaft Assembly (49) can be considered under two conditions; (1) with Rotary Control not depressed, and (2) with Rotary Control depressed. Under the first condition a stud in the upper surface of the assembly engages a slot in the Wind and Rewind Slide Plate (47). When the Rotary Control is turned to the right for Rewind operation the Slide Plate (47) is moved to the left by the action of the stud. As the Slide Plate moves, a shaped slot which engages one end of the Tie Bar Assembly (64) causes the Tie Bar to move back, pushing against the Equalizer Bar (88) and thus tightening the Feed Belt (101). The sliding action of the Slide Plate also moves the Idler Release Lever Assembly (48) by means of a stud in the same assembly (48) which engages another slot in the Slide Plate (47). This movement of the Idler Release Lever Assembly allows the Idler Spring (91) to pull the Idler Wheel (94) into contact with the Motor Pulley (99) thus driving the Flywheel (76), the Feed Belt (101), and the Feed Reel Spindle (89).

A third effect of the movement of the Wind and Rewind Slide Plate (47) is the application or release of the reel brakes. When the Rotary Control is in the neutral position the bottom stud on the Control Ball (40A) is in a vertical position and the stud end projects through slots in the Slide Plate (47) and the Play and Record Control Cam (42), and fits into a dimple or depression in the Control Spring Plate Assembly (65). The cross arm of this assembly (65) bears against the Brake Arm Adjustment Screws (77) and (77A), applying pressure to the brake arms, which in turn hold the brake shoes against the reel seats. As the Wind and and Rewind Slide Plate moves to the left for Rewind operation it pulls the control ball stud out of the dimple so that the Control Spring Plate moves up and releases the brakes. When the Rotary Control (3) is returned to neutral a reverse action takes place and the brakes are reapplied. The action of the control ball stud is such that the brakes are applied first to the reel from which tape is being removed, thus preventing any over run tape spilling.

When the Rotary Control (3) is turned to the left for Fast Forward operation, the Wind and Rewind Slide Plate (47) moves to the right and causes the Tie Bar (64) to pull the Equalizer Bar (88). This tightens the Take-up Belt (97) on the Take-up Pulley (98) and the Belt Pulley (100), and forces the outer surface of the

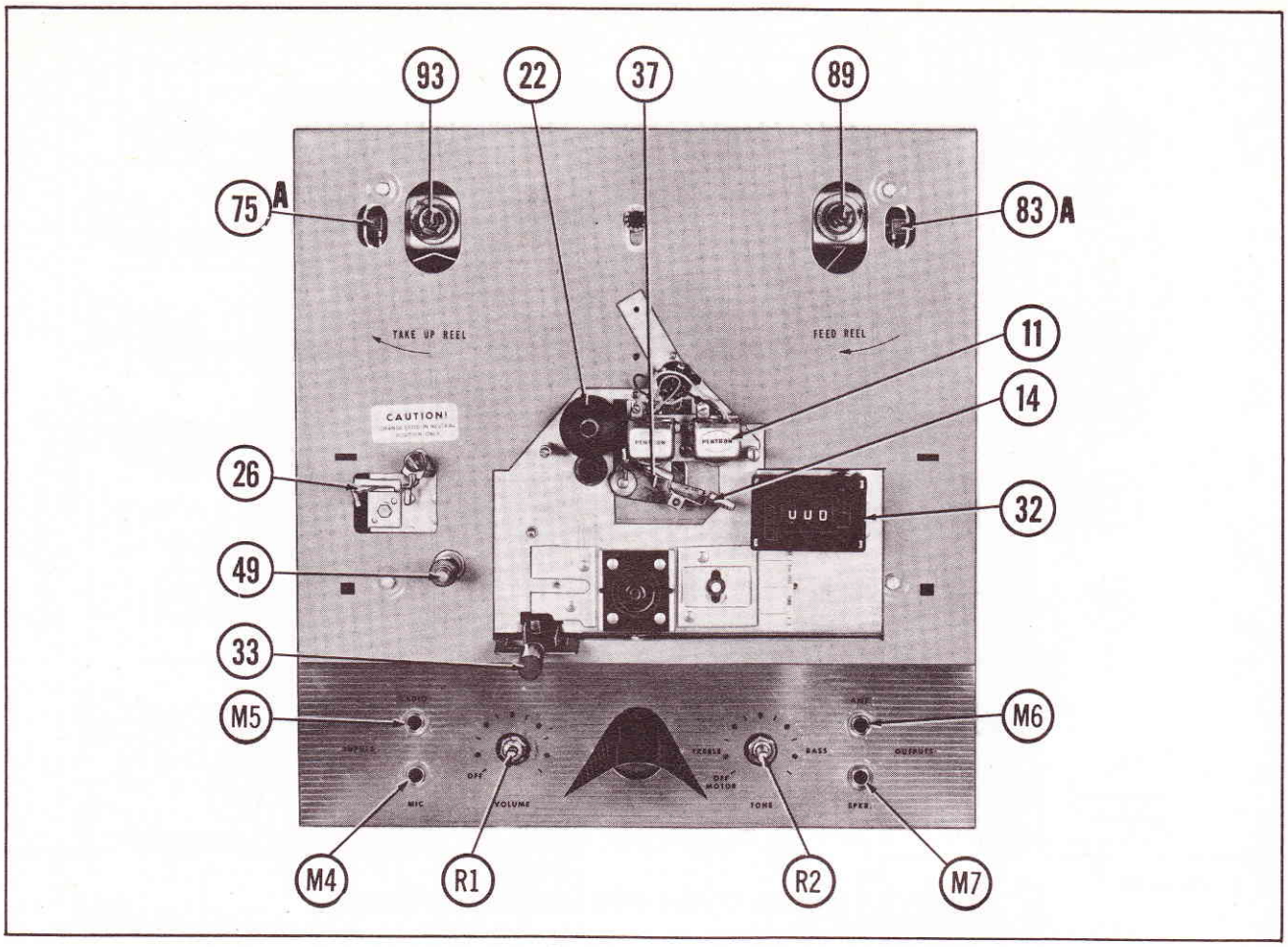


Figure 3. Top View Of NL-2 With Escutcheons Removed.

belt against the Motor Pulley (99). Rotation of the Motor Pulley then drives the Take-up Reel at fast forward speed. The brakes are released by the movement of the Slide Plate (47) but the Control Ball Stud (40A) is moved to the right instead of to the left as during Rewind operation. When the Rotary Control is returned to Neutral the brakes are reapplied first to the Feed Reel, thus preventing over run and tape spilling.

For the second mode of operation the Rotary Control (3) is depressed before being rotated. Rotation is then limited to clockwise direction, for playback or recording. As the Rotary Control is depressed the upper stud is disengaged from the Wind and Rewind Slide Plate (47) and a stud on the bottom of the Control Shaft assembly engages a slot in the Play and Record Control Cam (42). As the Rotary Control (3) turns, the Record Control Cam (42) rotates about a pivot, acting on three other parts at the same time. One arm of the Cam (42) moves the control ball stud to release the brakes and the other arm frees the Slide Plate Assembly (43) and pushes against the Rocker Arm (41). The Slide Plate Assembly moves in a direction to bring the Pressure Roller (22) against the Capstan to drive the tape. The Rocker Arm pivots and actuates the Idler Release Lever Assembly (48). Movement of the Slide Plate Assembly (43) also frees the Pressure Arm Lever (44) which in turn is moved by its spring (46) to bring the Pressure Plate and Pad Assembly (14) to bear against the Head assembly (11) or (12).

A third effect of movement of the Slide Plate Assembly is to free the Takeup Adjusting Lever Assembly (61) for rotation. Takeup Pressure Spring (57) actuates the Lever (61), forcing Takeup Adjusting Lever (54) against the Equalizer Bar (88) for correct takeup tension of Takeup Belt (97).

When the Rotary Control (3) is returned to Neutral a reverse action of all these parts occurs, but the brakes are applied equally to both reels since neither is turning at any great speed and danger of tape spilling is slight.

Volume Control (Model NL-1)

Turning the VOLUME control clockwise increases the volume level for both recording and playback.

Volume Control (Models NL-2 & NL-3)

Turning the VOLUME control clockwise increases the volume level for both recording and playback. The first few degrees of rotation operate the amplifier OFF switch.

Tone Control (Model NL-1)

The TONE control varies the relative strength of the bass and treble frequencies during playback, but has no effect on the tone while recording. The first few degrees of rotation operate the OFF switch which controls both the motor and amplifier.

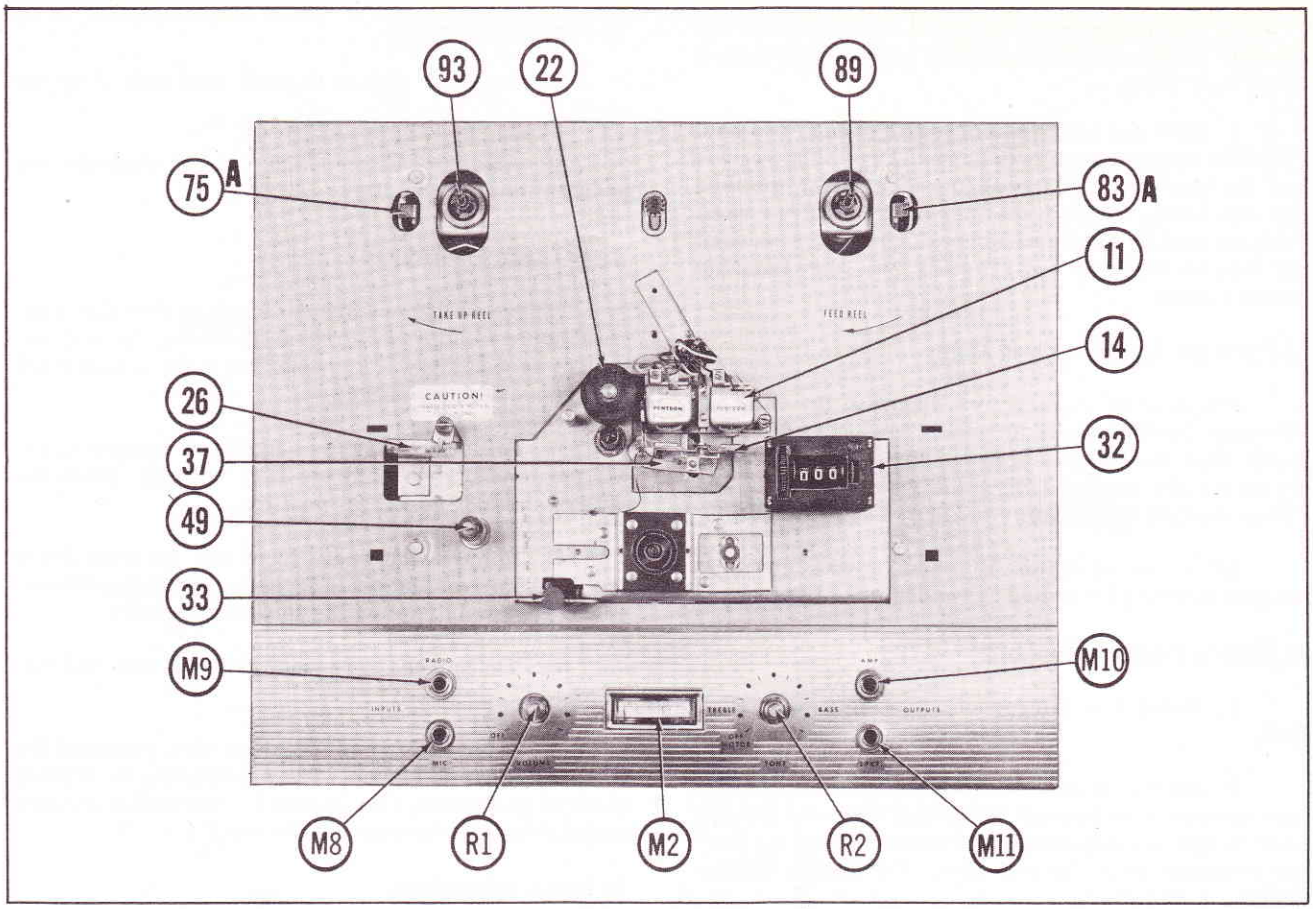


Figure 4. Top View Of NL-3 With Escutcheons Removed.

Tone Control (Models NL-2 & NL-3)

The TONE control varies the relative strength of the bass and treble frequencies during playback, but has no effect on the tone while recording. The first few degrees of rotation operate the MOTOR OFF switch.

Record Lock Button

Depressing the Record Lock Button (33) places the recording circuits into operation. If the Rotary Control is then depressed and rotated to the record position, the Record Lock Button will be held in recording position and recording proceeds until the Rotary Control is returned to neutral. This automatically releases the Record Lock Button.

Automatic Index Counter

The Automatic Index Counter (32) provides a means for locating recorded material anywhere on the tape. The counter is used on Models NL-2 and NL-3. Set the counter to zero at the beginning of a reel by rotating the reset knob. The counter is driven by means of a Flexible Shaft (103) connected to the Feed Reel Spindle (89).

Automatic Shut-Off Switch (Early Versions)

The Automatic Shut-Off Switch is located between the erase and playback heads on Model NL-3. When tape is properly threaded it falls between the contacts of this switch. Thus, when the end of a reel of tape is reached, or, in the event of tape breakage, the contacts will close.

The switch contacts of relay (M5) are in series with the motor circuit and are held closed by current through M5. The Shut-Off Switch is in parallel with the windings of relay (M5) so that when the Shut-Off Switch closes at the end of a reel it shorts across the relay windings and the relay switch opens, breaking the drive motor circuit.

Automatic Shut-Off Switch (Late Versions)

The Automatic Shut-Off Switch is located to the left of the play-record and erase head assembly on Model NL-3. When tape is properly threaded it falls between the metal post and the switch arm finger. Thus, when the end of a reel of tape is reached, or, in the event of tape breakage, the metal finger is allowed to move into the metal post, opening the switch which breaks the motor circuit.

OPERATING INSTRUCTIONS

Tape Loading And Threading

1. Place a reel of tape on the right hand (supply) spindle so that the reel will turn clockwise when tape is pulled from the reel. Use "A" wind tape – that is, tape that is wound coated side inwards. "B" wind tape can be easily changed to "A" wind by giving the tape a half twist before threading, and running the tape through Fast Forward or Rewind operation.

2. Place an empty reel on the left hand (take-up) spindle. Make sure that both reels are properly seated on the reel rests.

3. Reel out a convenient length of tape and hold a section straight with both hands. Drop this section into the tape slot and thread the free end of the tape into one of the slots in the hub of the take-up reel. Turn the reel by hand until several turns have secured the tape to the reel and all slack has been taken up between reels.

To Turn On Amplifier And Motor

Prepare to record or playback by turning "Volume-On-Off" Control to the "on" position. On Model NL-1 this control also turns on the drive Motor, but on Models NL-2 and NL-3 the motor switch on the "Tone" control must also be turned to the "on" position.

Allow the amplifier to warm up for about 30 seconds before proceeding to record or playback.

To Record From Microphone

1. Insert the microphone plug into the "Mic" jack.

2. Set the record level. This can be done before tape movement is started by holding down the Record Lock Button and adjusting the Volume control for proper response from the indicator. The proper volume levels are as follows:

(a) Model NL-1 (Neon Bulb) -- Adjust the volume level so that the loudest portions of the signal cause the lamp to flash intermittently.

(b) Model NL-2 (Magic Eye) — Adjust the volume level so that the loudest portions of the signal just cause the eye to close.

(c) Model NL-3 (VU Meter) — Adjust the volume level so that the peaks of meter deflection do not go past zero, or into the red area of dial calibration.

3. Hold the Record Lock Button down and turn the Rotary Control to the right, thus starting the recorder in motion. When through recording, turn the Rotary Control to neutral. The Record Lock Button will automatically release and deactivate the record circuit.

To Record From Radio, TV, Or Phonograph

1. Connect the output signal from the radio, tuner, TV, or phonograph to the "Radio" input jack of the recorder.

2. Proceed as under "To Record From Microphone", step 2.

To Play A Recording

1. Depress Rotary Control and turn it to the right.

2. Adjust "Volume" and "Tone" controls for desired listening quality.

Dual Track Recording

These recorders are designed so that only one-half the tape width is recorded at a time, thereby resulting in dual-track recording. To make a dual-track recording proceed as follows:

1. After a reel of tape has been recorded, i.e. all the tape wound onto the take-up reel, place the Rotary Control in neutral position.

2. Remove the reels from the recorder, turn the full reel over and place it on the right-hand spindle. Place the empty reel on the left-hand spindle.

3. Thread the tape and proceed with the recording.

4. After the second track has been recorded the first track can be played, without rewinding, by trading reels on the spindles as in step 2, rethreading the tape and placing the recorder in Playback operation.

To Erase Recordings

These recorders automatically erase previous recordings as new recordings are being made. If it is desired to erase without recording new material, set all controls as if recording but do not plug in the microphone or other program source, and run the tape through the machine. For best results, set Volume Control at zero.

To Use An External Speaker

Plug the external speaker into the jack marked "SPKR". On Models NL-2 and NL-3 this automatically disconnects the internal speakers. On Model NL-1 plugging in an external speaker places it in parallel with the internal speaker.

To Use An External Amplifier

Connect the recorder jack marked "AMP" to the input of the external amplifier. This input should be one designed to accept a high level signal requiring no further equalization for flat playback response.

To Use As A P.A. System

Any of the Model NL-1, NL-2, or NL-3 recorders can be used as a public address system by plugging a microphone into the RADIO input jack.

MECHANICAL ADJUSTMENTS

Equalizer Bar Adjustment

This adjustment is made by loosening Socket Head Screw (27) and shifting the Equalizer Bar (88) forward or backward. Make the adjustment as follows:

First, remove the Spindle Caps (1) and Reel Rests (2). With the Rotary Control (3) in neutral position, move the Equalizer Bar (88) to a position such that the Take-Up Spindle (93) is on the verge of spinning without any pressure being exerted on the Equalizer Bar (88)

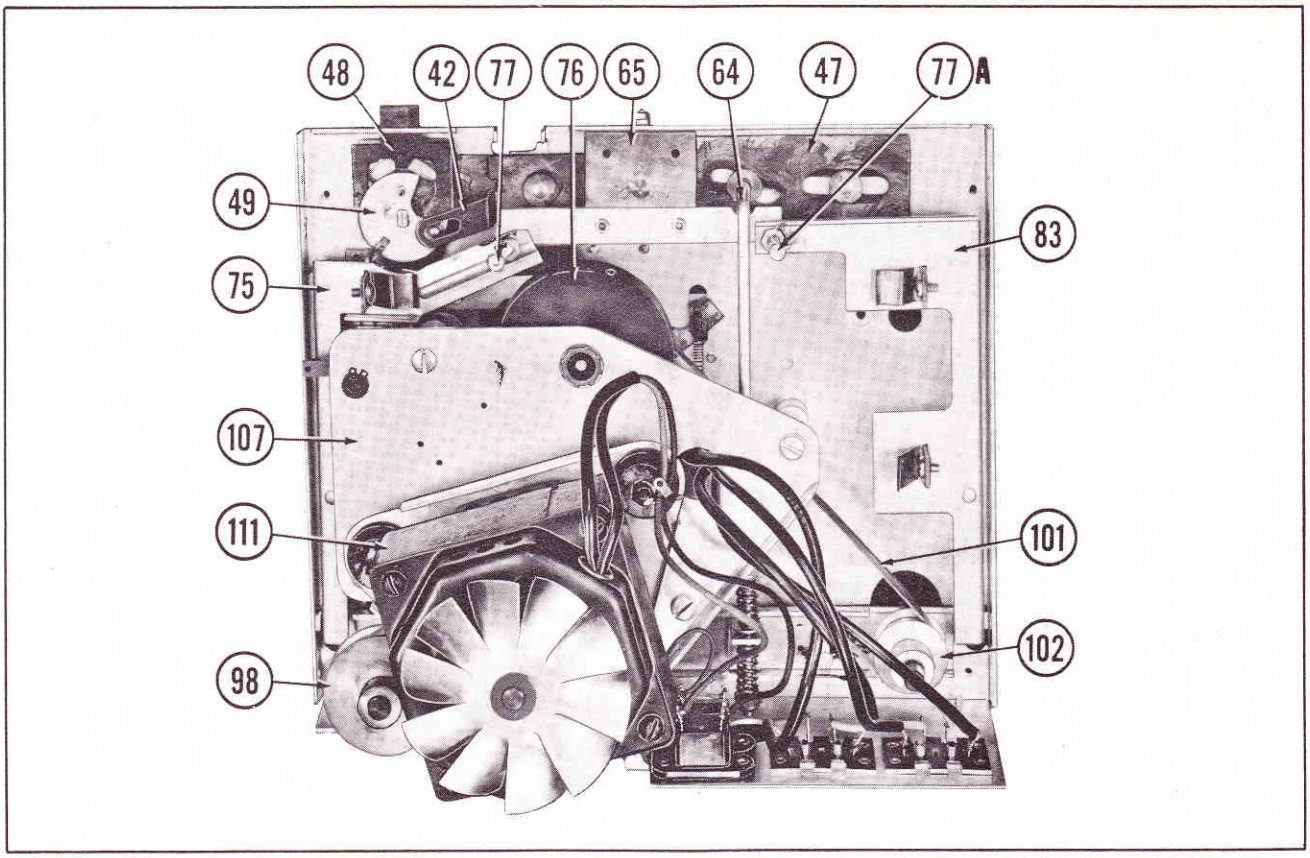


Figure 5. Bottom View Of TM-1 Mechanism.

from the Tie Bar (64). After adjustment is made be sure the socket head screw (27) is tightened securely. The Equalizer Bar Adjustment Screws (77B) are adjusted by turning both screws down until they hit the mechanism plate. Then back the screws off 1/4 turn and lock them down with Lock Nuts (78B). This adjustment acts as a stabilizer for the equalizer bar.

Tie Bar Pressure Adjustment

The amount of pressure exerted on the Equalizer Bar (88), by means of the Tie Bar (64), is adjusted by movement of the Elastic Stop Nuts (79). The elastic stop nuts should be adjusted so as to allow the Forward and Rewind positions on the Rotary Control to function freely and still exert enough pressure on the equalizer bar for adequate Forward and Rewind performance. To determine if performance is adequate test the Rewind with a full 7" reel on the feed side. To test for Wind place the full 7" reel on the take-up side.

NOTE: The Tie Bar (64) must be readjusted whenever the Equalizer Bar (88) is adjusted.

Takeup Adjustment

This adjustment is accomplished by bending the Take-Up Pressure Spring (54). Bending the spring closer to the Equalizer Bar (88) increases the pressure on the equalizer bar thus giving a stronger take-up. Bending the spring away from the equalizer bar gives a weaker take-up. If bending the spring does not give adequate results, loosen the screw which mounts the spring and move the spring in the proper direction for optimum adjustment.

Brake Adjustment

After equalizer bar adjustments have been made the brakes are ready to be adjusted. First put a full 5" reel of tape on the feed reel side, and an empty 7" reel on the take-up side. Wind about 1/4 of the tape on to the 7" reel. While operating the Rotary Control from "Rewind" to "Neutral", tighten the Left Brake Adjusting Screw (77) until the reels stop in about 1 revolution without spilling tape. Next, reverse the procedure by placing the 5" reel of tape on the take-up side and the empty 7" reel on the feed side. Adjust the Right Brake Adjusting Screw (77A) so that the reels stop in "Fast Forward" to Neutral" in about 1 revolution. Next put a full 7" reel of tape on the feed side and an empty 7" reel on the take-up side. Run about 100' of tape on to the take-up reel, then go directly into "Rewind". When the take-up reel is almost empty, place the Rotary Control in "Neutral". The reels should stop in about 3 or 4 revolutions without spilling tape. Next, reverse the procedure by placing the full 7" reel on the take-up side and rewind about 100' of tape on the feed reel. Go directly into "Fast Forward" until the feed reel is almost empty. Then place the Rotary Control in "Neutral". The reels should stop in about 3 or 4 revolutions without spilling tape. After the brakes are adjusted, check the take-up and rewind. If the take-up or rewind has been affected, readjust. If it is difficult to get adequate take-up, the brakes may have been adjusted too tightly. Readjust the brakes to rectify this condition.

Idler And Speed Change Adjustment (Models NL-2 & NL-3)

Loosen the set screw and nut which secures the Speed Change Shaft (69) to Idler Channel (70). Adjust the position of idler channel assembly so that the full perimeter of the Idler Wheel (94) rides on the perimeter of the Motor Pulley (99). The idler wheel should not ride on the edge of the motor pulley. After the idler channel has been positioned correctly in a vertical direction on the speed change shaft, check to see that the shaft has not rotated so that the speed change sector no longer engages the slot in the Speed Shift Lever (26). If necessary loosen the Speed Change Shaft Knob (24) and reposition the Speed Change Sector (25).

Play-Record Head Alignment

The Play-Record Head is correctly aligned for azimuth when the magnetic gap is at an exact right angle with the direction of tape travel. One of the best ways for making an azimuth adjustment is by means of an alignment tape and a meter. A substitute method would be to play back a recording and adjust the head for maximum high frequency content in the output, as judged by ear. The use of alignment tape and meter is as follows:

1. Connect the meter to the "AMP" output jack and set it for a low AC voltage range.

2. Loosen the record head mounting screw just the slightest amount, so that the head may pivot about this screw as a center, but cannot slip up or down vertically.

3. Play the alignment tape and adjust the Azmur-X spring loaded screw for maximum output on the meter.

4. Check to see that the height of the head has not been disturbed. The center line of the head and pole piece must be lined up so that the pole piece is at the same level as the tape guides and tape.

5. Tighten the head mounting screw and seal the Axmur-X adjustment screw with a small amount of household cement.

Record Level Indicator Adjustment (Model NL-1)

The neon lamp on your tape recorder indicates the maximum undistorted recording level, and although set at the factory, it may require a minor adjustment.

When this becomes necessary, the following adjustment procedure is suggested.

1. Allow the recorder to thoroughly warm up. (usually about 5 minutes).

2. Insert a thin screwdriver through the "AMP" jack hole.

3. Set the volume control at approximately 2 o'clock and make a normal recording holding the microphone 4" to 6" from the mouth. Speak into the microphone at a normal conversational level.

4. Slowly turn the screwdriver until the neon bulb just flickers at the peak or loud portions of your voice.

To check the above setting, playback the recording to see that the level of playback is entirely adequate and not distorted at normal listening levels.

If playback is weak, repeat step 4 but slightly increase the volume control.

If playback is loud and distorted, repeat step 4 but slightly decrease the volume control.

Depending on the individual's voice the above procedure may have to be repeated several times before the desired recording level is obtained.

PARTS REPLACEMENT

How To Replace A Pole Piece

Remove the head assembly by loosening the mounting screws which hold down the assembly. The pole piece is then removed by inserting a non-magnetic screw driver between the head can and the pole piece and prying the pole piece by breaking the glue joint. The new pole piece is then inserted between the two laminations provided for each leg of the pole piece. After the pole piece is in position it should be cemented from the sides with household cement. The head assembly is then screwed into place and the heads aligned.

How To Replace A Play-Record Head

Remove the #6-32 Phillips Oval Head Mounting screw (6) and the Head Cover Casting (5). This will give access to the heads. Unsolder the head leads at the head plug socket or at the terminal lugs. Loosen the Azmur-X adjustment screw and the head mounting screw (see Fig. 6). The head can now be replaced. The head should be aligned for correct aximuth after replacement.

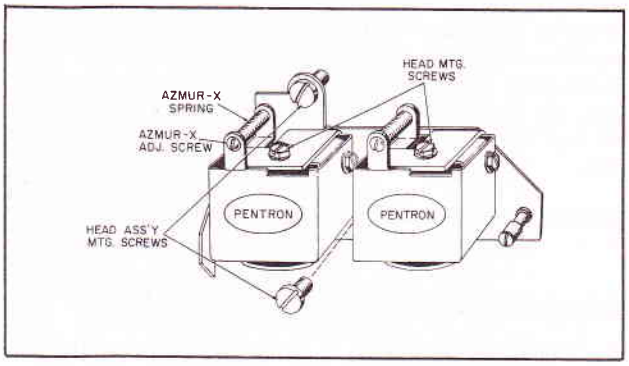


Figure 6. Head Adjustment Points.

How To Replace A Pressure Roller

Remove the #6-32 Phillips Oval Head Mounting Screw (6) and the Head Cover Casting (5). Remove the

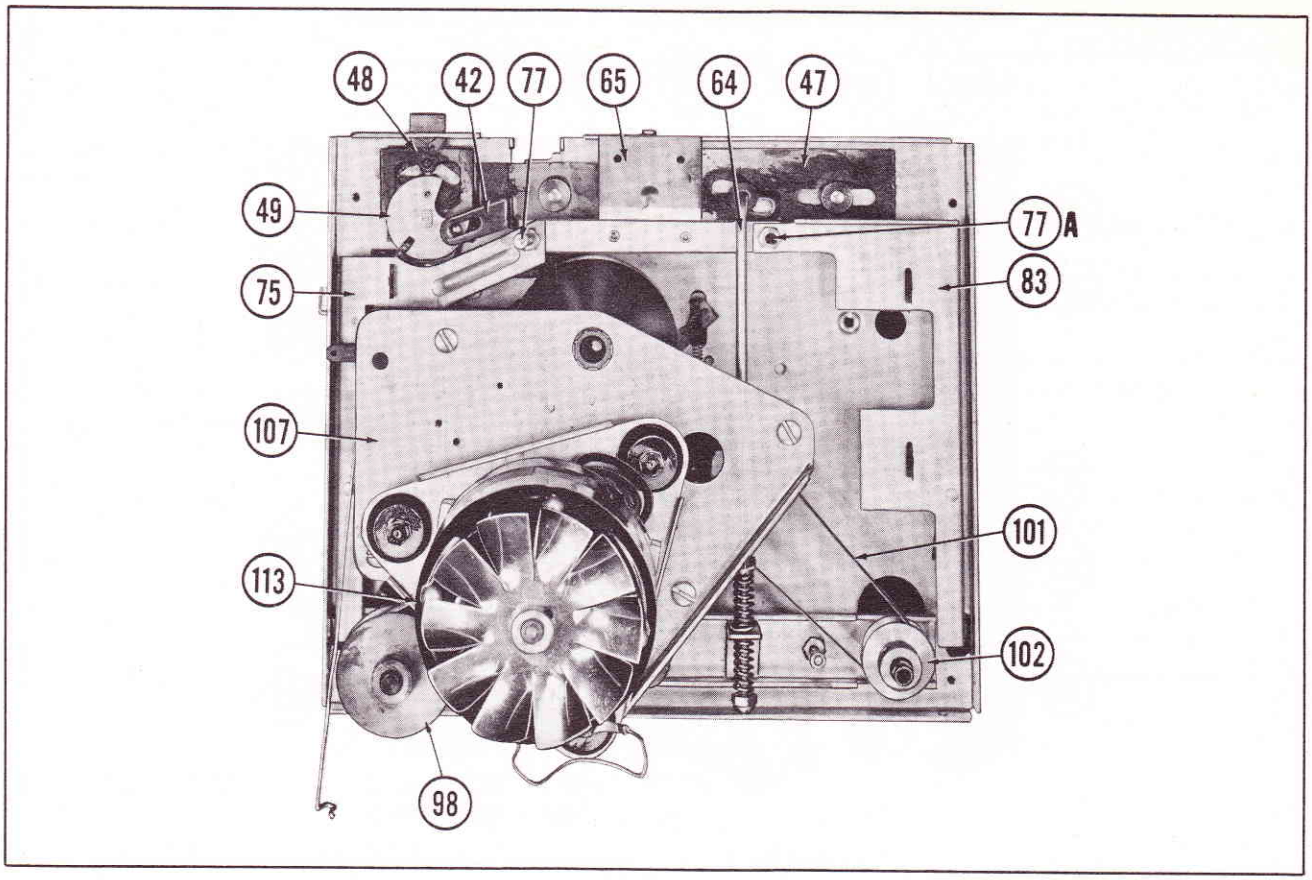


Figure 7. Bottom View Of NL-1 Mechanism.

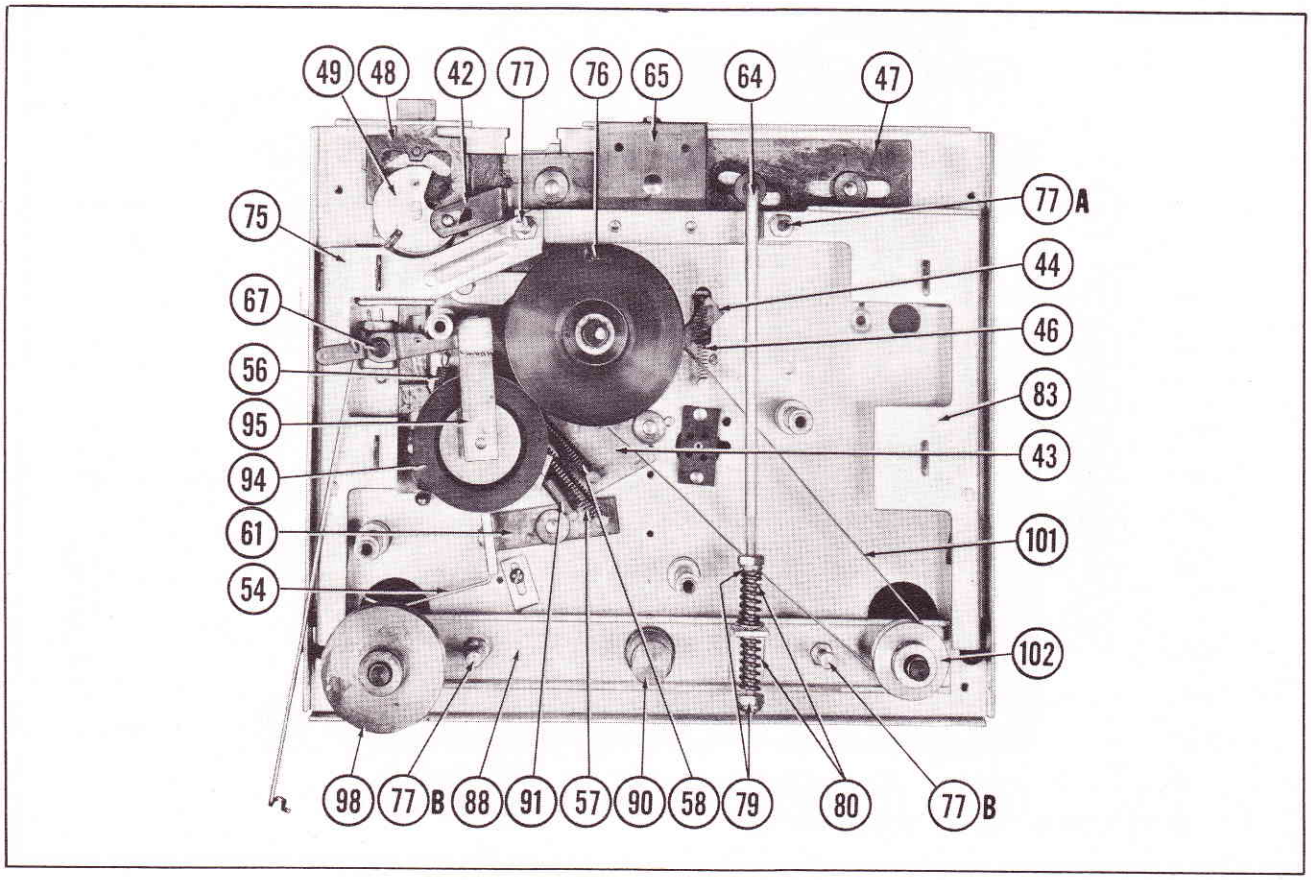


Figure 8. Bottom View Of NL-1 With Motor Mtg. Plate Removed.

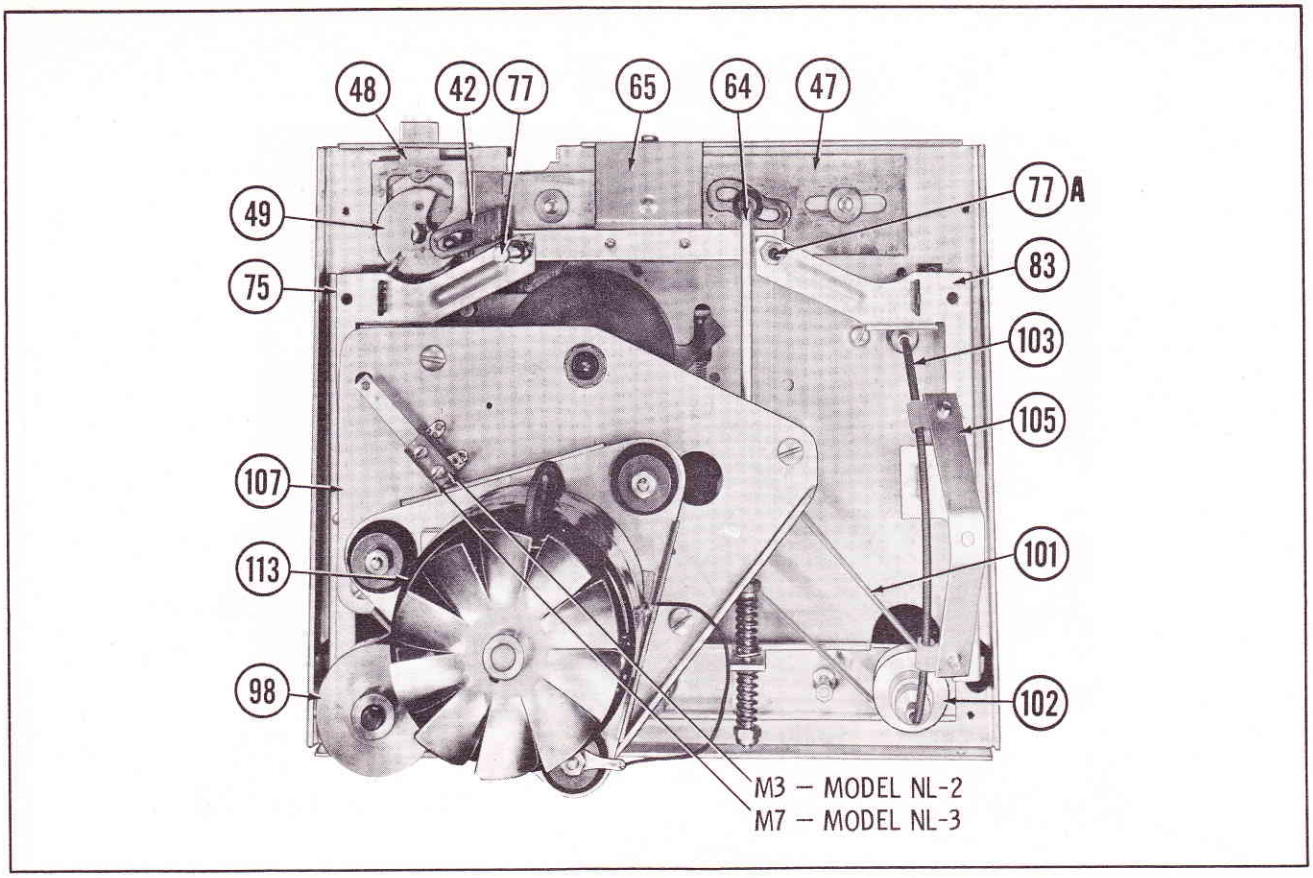


Figure 9. Bottom View Of NL-2 & NL-3 Mechanism.

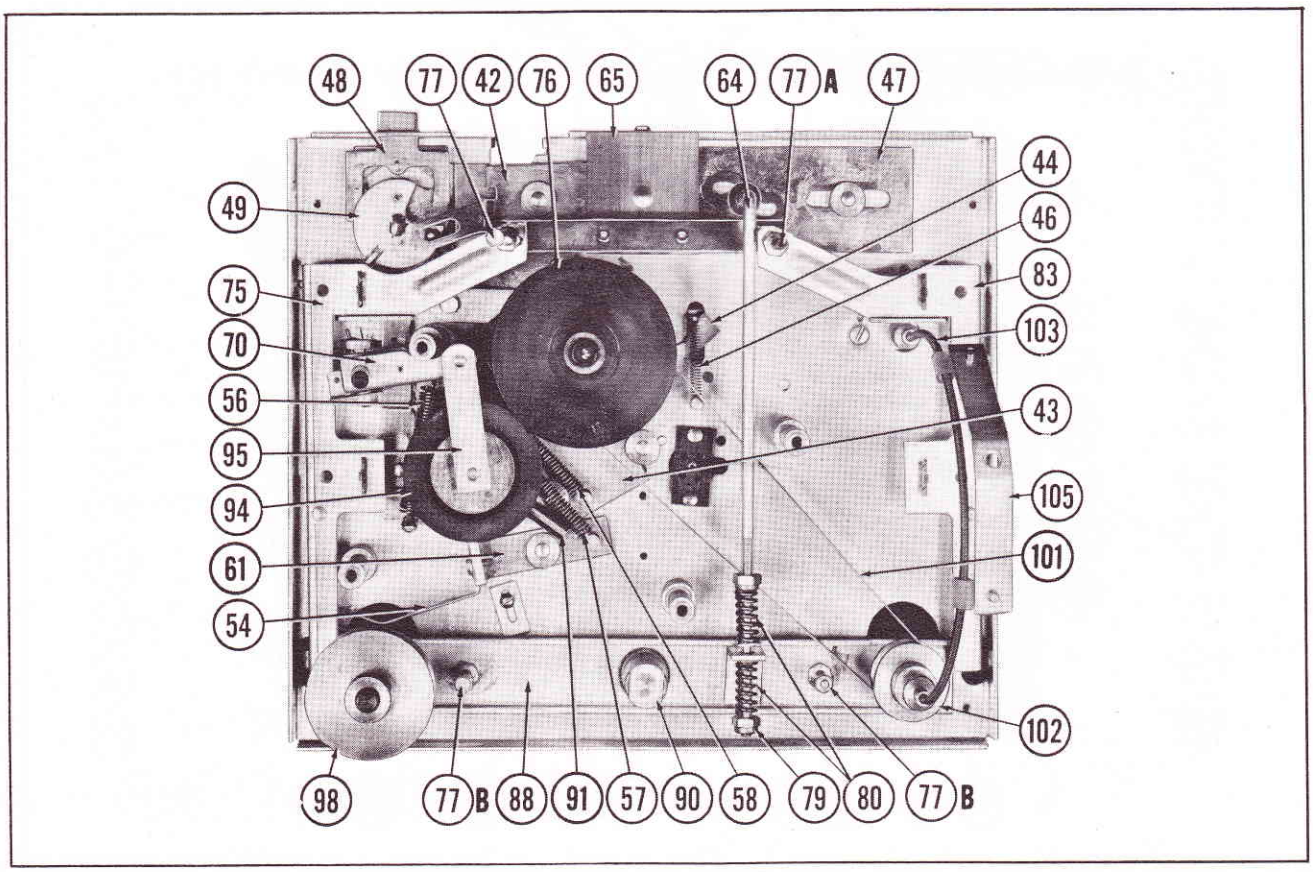


Figure 10. Bottom View Of NL-2 & NL-3 With Motor Mtg. Plate Removed.

crescent retaining ring (21) and lift off the pressure roller. Clean the pressure roller stud and clock steel washer (23) with a dry cloth. Apply grease to the inside bottom of the new pressure roller. Put the new pressure roller on the pressure roller stud and wipe off any excess grease at the top of the roller. Replace the crescent retaining ring. Do not get any grease on the driving surface of the pressure roller as this will hinder the operation of the machine.

How To Replace An Idler Wheel

Remove the Motor Support Plate (107) by taking out the 4 #10-32 machine screws (108). This will give access to the Idler Wheel. Slide the Idler Spring Clip (92) forward and slip it off the shaft, then remove the clock steel washer and the Idler wheel from the Idler stud. Clean the stud before installing a new Idler. Install idler wheel in reverse order, being careful not to get any grease on driving surface of wheel. Replace Motor Support plate.

How To Replace An Equalizer Bar

On Model TM-1 first remove the back plate containing output jacks and slide switch. Remove the Spindle Caps (1), Reel Rests (2) and Head Cover Casting (5). Loosen the set screws on feed and take-up pulleys. (Remove flexible shaft on feed reel spindle, Models NL-2 & NL-3). Lift out both reel spindles from top of unit and remove the elastic stop nut (79) and spacer (80) from the end of the Tie Bar (64). Remove socket head screw (27), Equalizer Pivot Stud (90), and Equalizer Spacer (87). Equalizer bar can then be removed and replaced. Clean all bearing surfaces and washers and lubricate properly before replacement of bar. After new bar is installed follow instructions for Equalizer Bar, Tie Bar, and Brake Adjustments.

How To Replace A Motor Assembly

Place Rotary Control (3) in Neutral position. Remove the 3 nuts (73) and washers which hold the Motor Plate to the rubber shock mounts. Lift motor off the three mounting studs. When replacing motor make sure that motor pulley (99) is outside the take up belt (97) as shown in the exploded view.

How To Replace A Take-Up Belt

The removal and replacement can probably be most easily accomplished if the back of the unit is facing up. Slip the belt off the take-up pulley (98) first. Start the belt up over the edge of pulley and assist the action by turning take up reel seat by hand. Then remove the belt from the Belt Pulley (100) by slipping the belt up through the clearance in the Motor Support Plate (107). Replacement is done in the reverse order. Make sure that the lettering is on the inside of belt then slip the belt over the Belt Pulley (100) by working it up through the clearance in the Motor Support Plate. Pull the belt around under the Motor Pulley (99) and work it up between the Motor Pulley and the motor mounting stud, towards the Take Up Pulley (98). Slip the belt over the Take Up Pulley. The Equalizer Bar and Tie Bar may require readjustment after the new belt is installed.

How To Replace A Feed Belt

Turn the unit upside down and remove the head leads and the flexible shaft. On Models NL-1, NL-2, and NL-3 the head leads can be unplugged but on the basic TM-1 mechanism they will need to be unsoldered. The flexible shaft is used on Models NL-2 and NL-3. The belt can now be removed from the feed pulley but the Motor Support Plate (107) must be removed before the belt can be taken off the Flywheel and Capstan Assembly (76). Remove the four #10-32 screws (108) and remove the Motor Support Plate. The Feed Belt can now be completely removed and replaced. Make sure that new belt is installed with lettering on the outside. Reassemble in reverse order, making sure that Motor Support Plate is properly seated on the studs.

LUBRICATION

Although this mechanism is prelubricated at the factory, replacement of parts requires that they be lubricated in order to insure proper functioning. No part needs more than a slight film of grease where grease is specified or one drop of oil where oil is specified.

The following parts require greasing with fibre grease or a similar compound:

1. Play-record cam (42).
2. Wind-rewind slide plate (47).
3. Control spring (65).
4. Control Ball shaft (40A), bottom end.
5. Slide plate assembly (47).
6. Pressure roller bearing, (22) and (37).
7. Belt pulley (100).
8. Tie bar (64), front end.
9. Idler wheel bearing (94).
10. Record lock (33).
11. Equalizer bar pivot stud (90).
12. Take-up adjusting lever (61).
13. Pressure arm lever (44).
14. Pressure finger carrier assembly (37).

The following parts require oiling with 10W lubricating oil:

1. Feed spindle assembly (89).
2. Take-up spindle assembly (93).
3. Flywheel assembly (76).

CAUTION: Do not clean oilite bearings with cleaning solvent. Oilite bearings are permanently oiled, but in some cases where the bearings appear dry a drop of oil will be necessary.

CLEANING

The recording and erase heads, the capstan (76), and the pressure roller (22) are subject to an accumulation of tape coating oxide which is worn off the tape as it passes these parts. Clean these parts with a soft cloth and alcohol after every ten hours of running time.

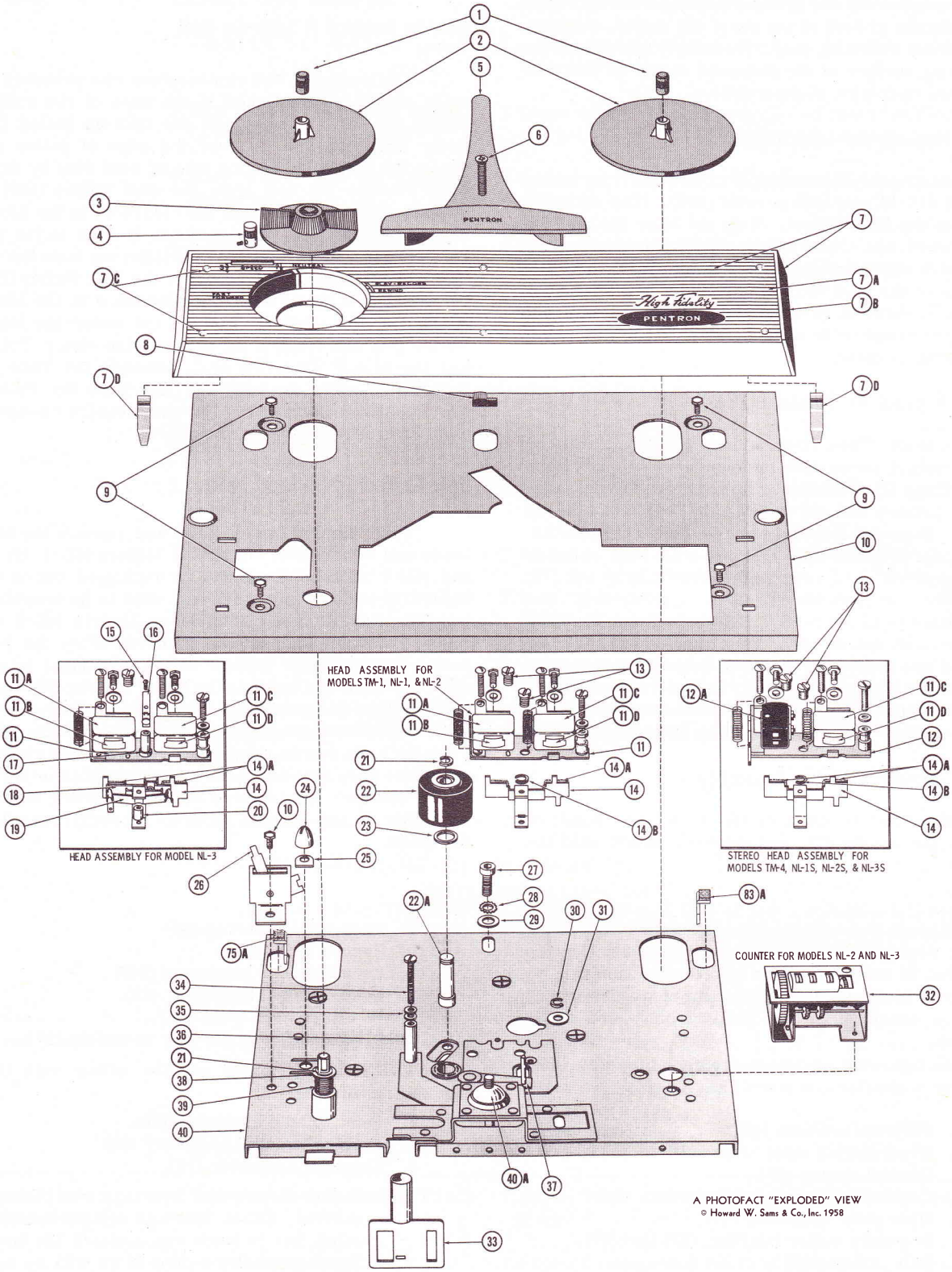


Figure 11A. Exploded View Of Parts Above Mechanism Plate

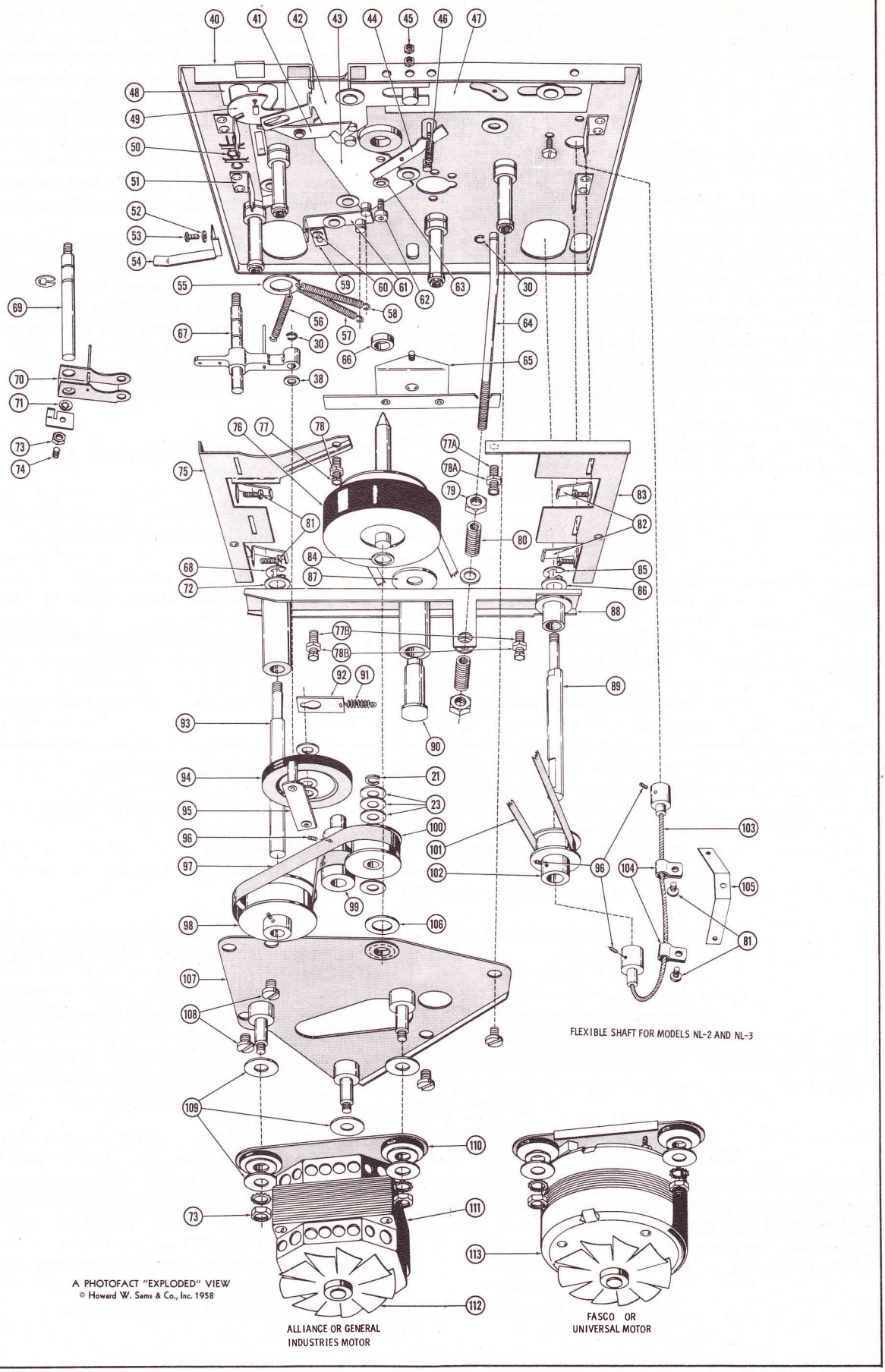


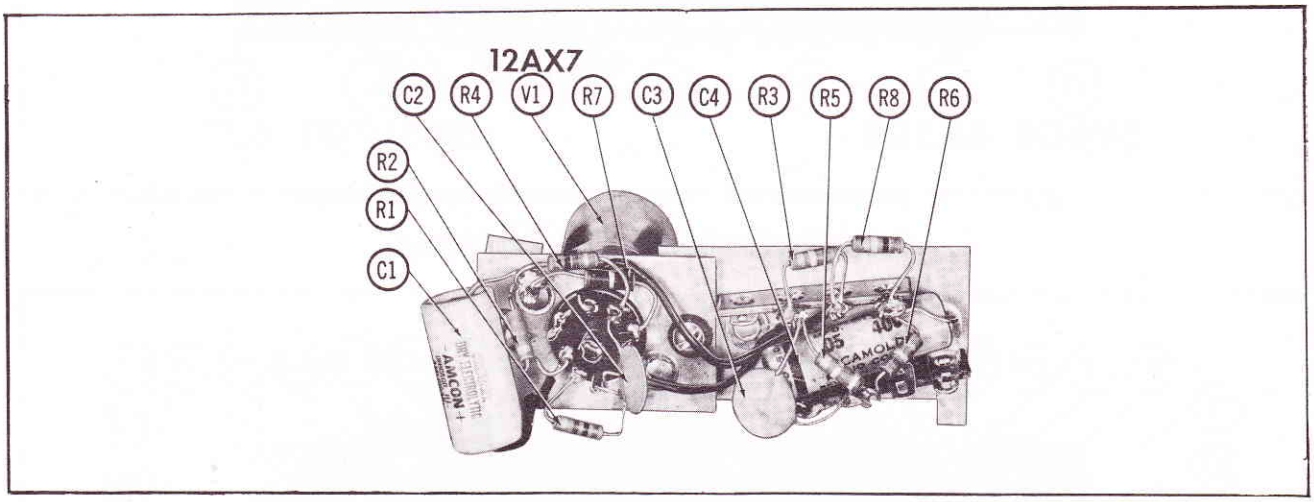
Figure 11B. Exploded View Of Parts Below Mechanism Plate

MECHANICAL TROUBLES AND PROBABLE REMEDIES

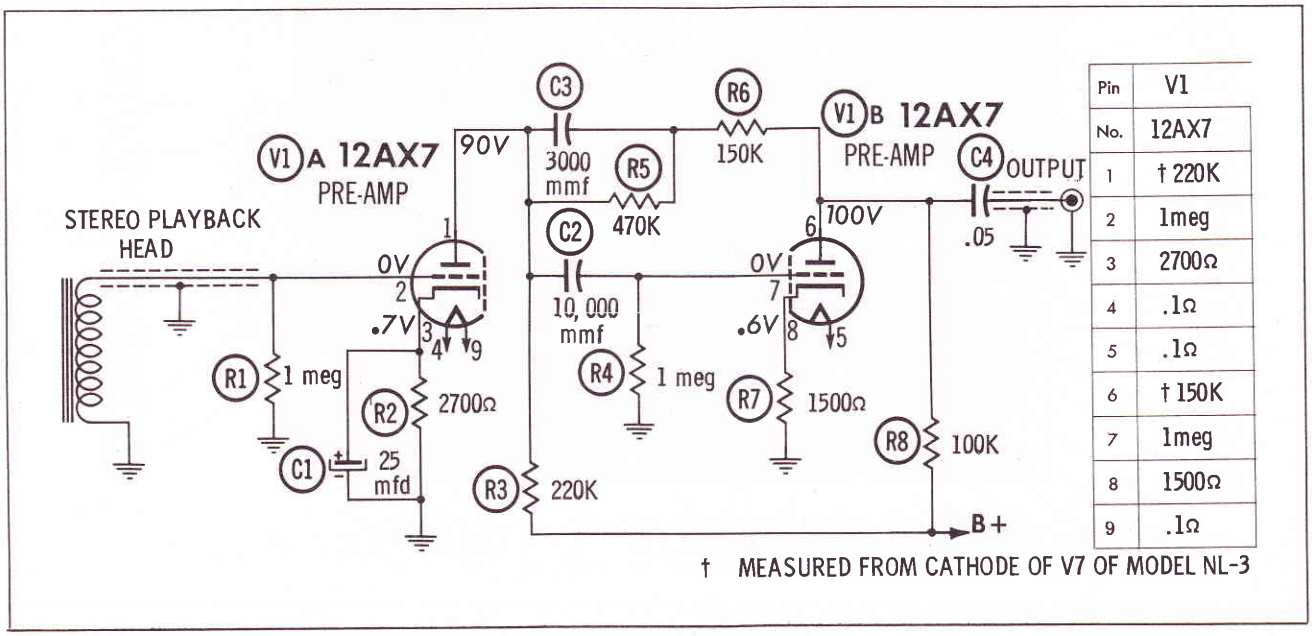
SYMPTOM	CAUSE	REMEDY
No rewind.	1. Glazed idler wheel (94).	1. Rub off glaze with a clean, dry, lint free cloth.
	2. Faulty tie bar (64) adjustment.	2. Adjust as described under "Tie Bar Pressure Adjustment".
	3. Idler wheel (94) slips against flywheel or motor pulley.	3. Clean idler wheel, flywheel, and motor pulley with alcohol. If idler wheel still slips, replace.
	4. Idler wheel (94) not adjusted properly.	4. Adjust as described under "Idler And Speed Change Adjustment".
	5. Binding feed reel spindle (89).	5. Remove "E" ring (85) and remove spindle from bearing. Clean bearing and spindle with a clean, soft cloth.
	6. Dragging brake linings. Brakes not adjusted properly.	6. Adjust brakes as described under "Brake Adjustment".
	7. Warped reel rest (2).	7. Replace reel rest.
	8. Feed belt (101) loose or broken.	8. Replace.
Flutter.	1. Motor pulley (99) not concentric to motor shaft.	1. Replace motor and pulley assembly.
	2. Excessive take-up.	2. Adjust as described under "Take-up Adjustment".
	3. Take-up belt (97) not installed properly.	3. Remove and replace belt as shown on "Exploded View".
	4. Dirty flywheel bearings.	4. Clean bearings and flywheel shaft with a clean, soft cloth.
Wow.	1. Foreign matter on idler wheel (94), motor pulley (99), flywheel (76), or take-up pulley (98).	1. Clean with a cloth and alcohol.
	2. Defective idler wheel (94).	2. Replace.
	3. Defective pressure roller (22).	3. Replace.
	4. Reel spindles (89) and (93) binding.	4. Remove "E" ring (85) on top of spindles and remove spindles from bearings. Clean bearings and spindles with a clean, soft cloth.
	5. Brakes improperly adjusted.	5. Adjust as described under "Brake Adjustment".
No Wind (Fast Forward).	1. Binding take-up spindle (93).	1. Remove "E" ring (85) on top of spindle and remove spindle from bearing. Clean bearing and spindle with a soft, clean cloth.
	2. Take-up belt (97) loose, twisted, or broken.	2. Replace belt.
Tape spillage or insufficient braking.	1. Faulty brake adjustment.	1. Adjust brakes as described under "Brake Adjustment".
	2. Worn brake linings.	2. Replace linings and readjust brakes.
	3. Worn out or loose control spring (65).	3. Adjust or replace control spring.
	4. Excessive play in equalizer bar (88).	4. Readjust equalizer bar as described under "Equalizer Bar Adjustments".

ELECTRICAL TROUBLES AND PROBABLE REMEDIES

SYMPTOM	CAUSE	REMEDY
Poor high frequency response.	1. Play-Record head improperly aligned	1. See "Play-Record Head Alignment".
	2. Worn pole piece on Play-Record head.	2. Replace pole piece and realign for azimuth.
No erase -- distorted or weak record.	1. Bias-Erase oscillator not working.	1. Check oscillator tube and oscillator coil. Replace if necessary.
No erase — records on top of previous recording.	1. Defective erase head or circuits.	1. Check circuits — replace head if necessary.
Distorted recording — play-back function O.K.	1. Improper recording level.	1. Check operation of level indicator. Check setting of adjustment for level indicator (Model NL-1).
	2. Defective microphone.	2. Compare with microphone known to be good.



STEREO PREAMPLIFIER — BOTTOM VIEW



Pin No.	V1 12AX7
1	† 220K
2	1meg
3	2700Ω
4	.1Ω
5	.1Ω
6	† 150K
7	1meg
8	1500Ω
9	.1Ω

STEREO PREAMPLIFIER SCHEMATIC

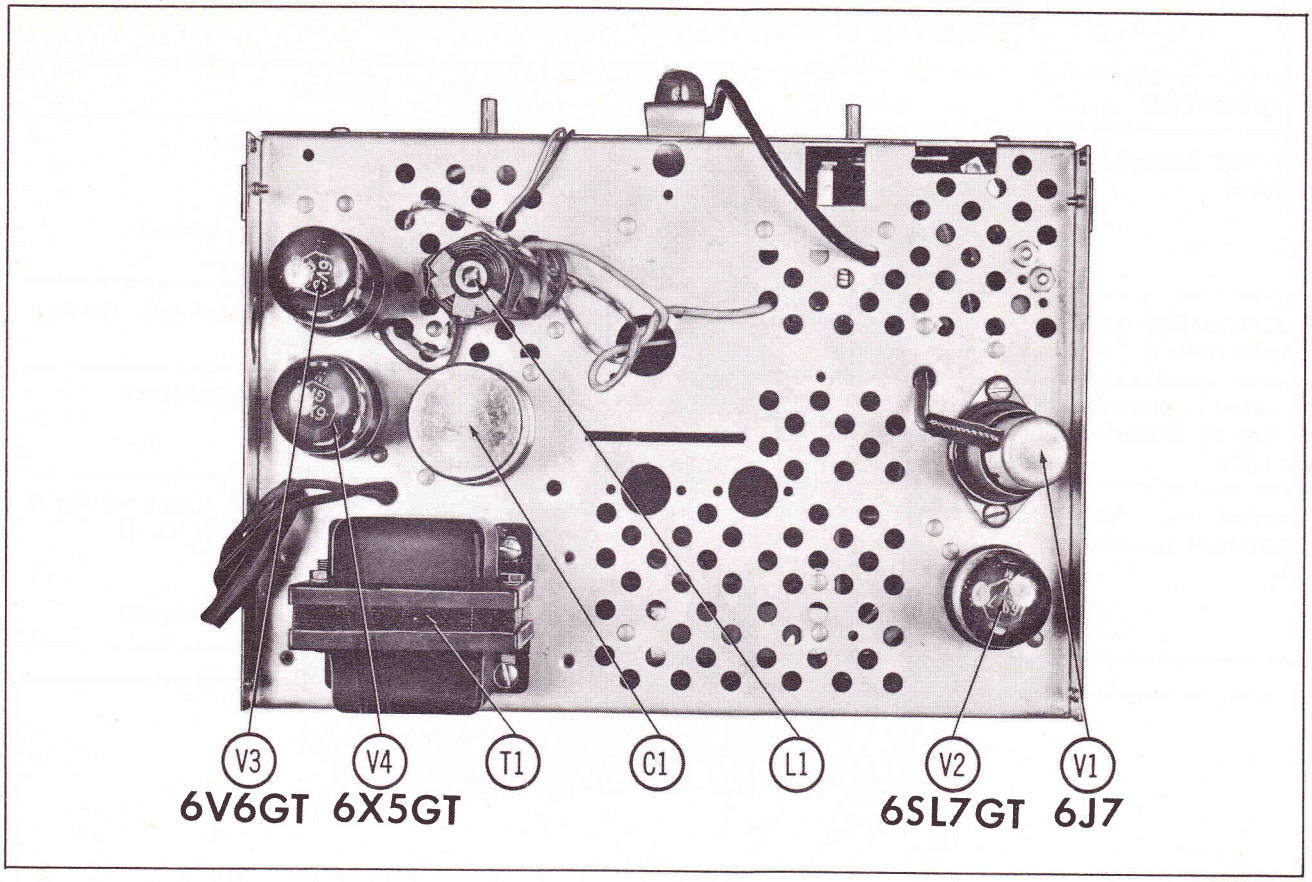


Figure 12. Rear View Of NL-1 Amplifier.

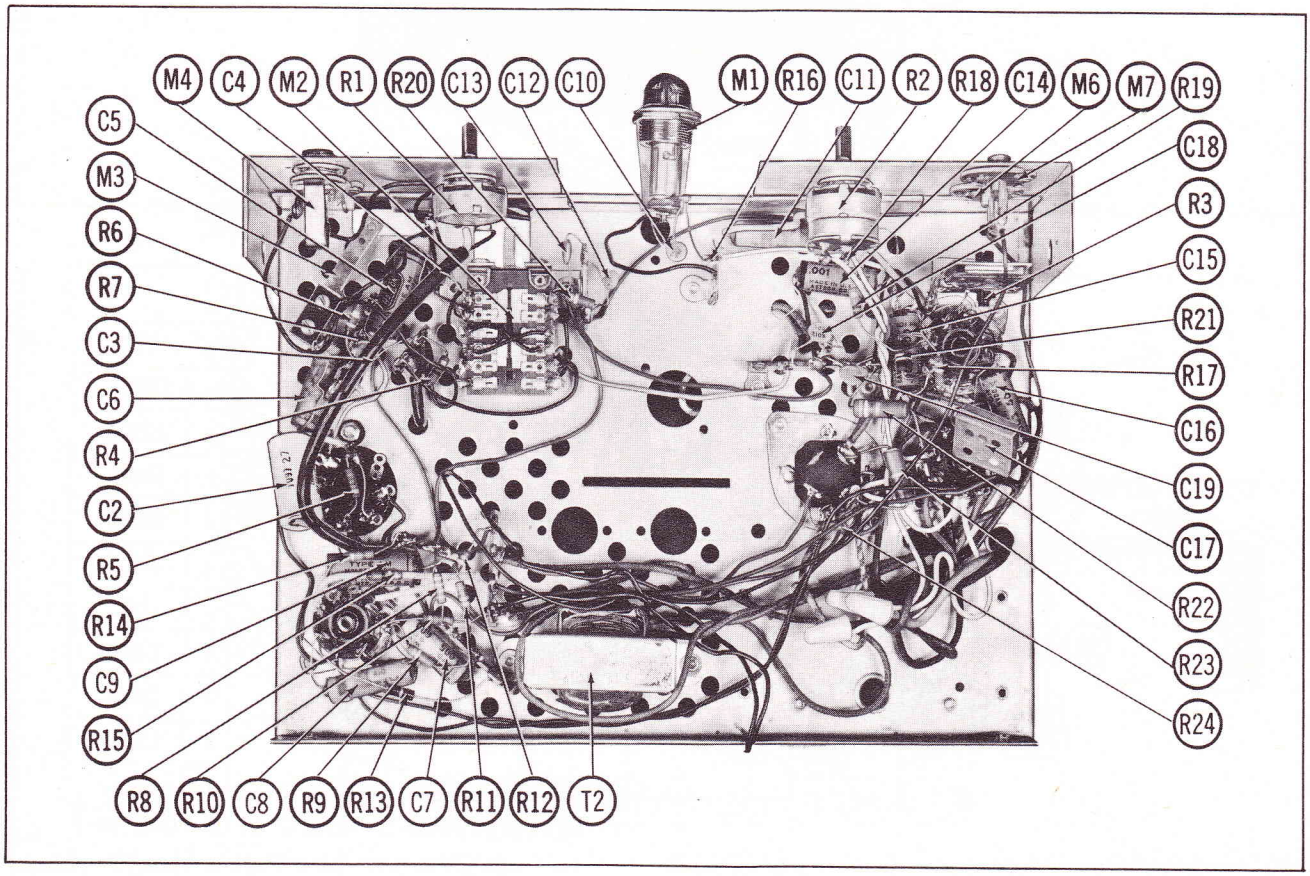
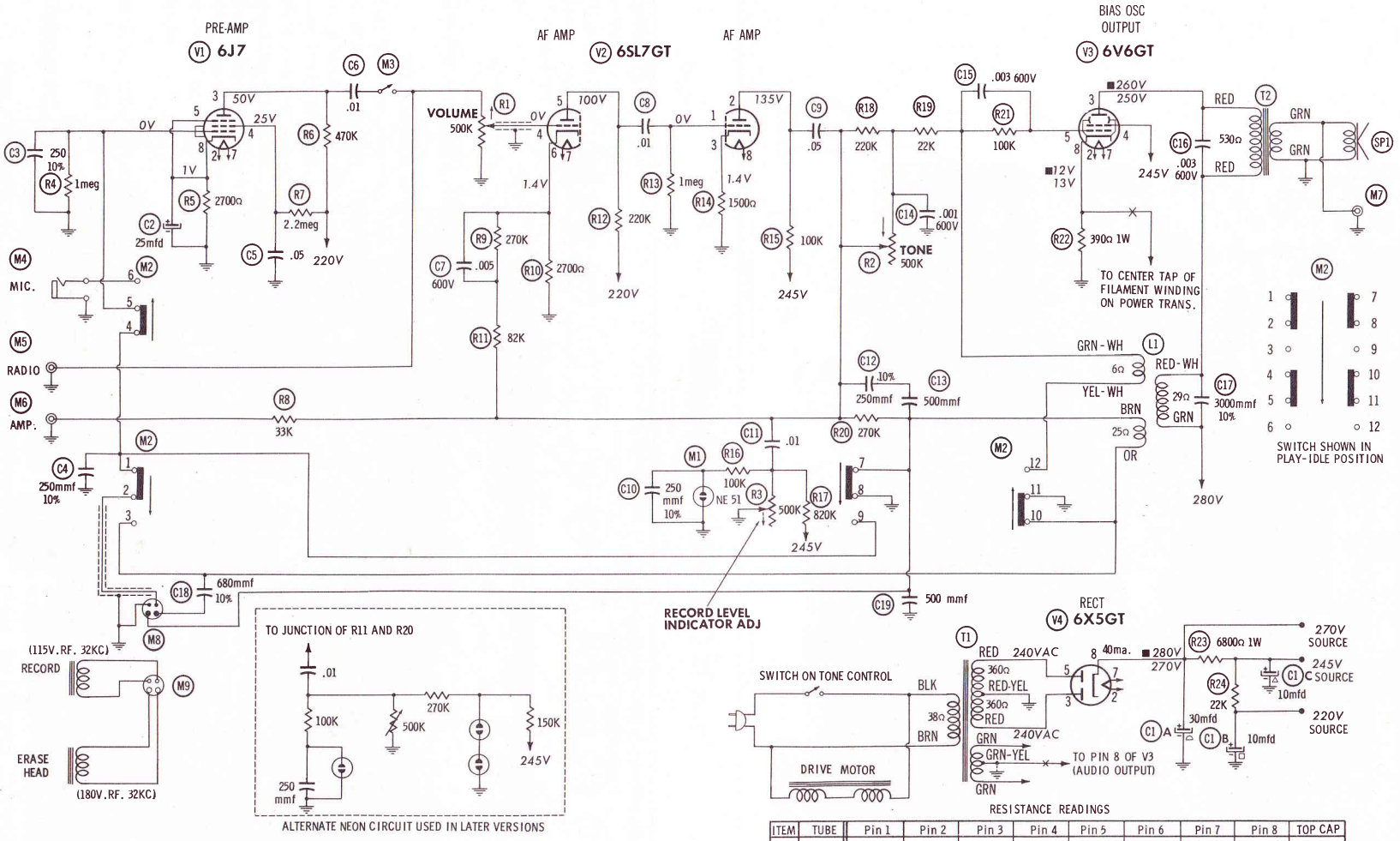


Figure 13. Front View Of NL-1 Amplifier.



RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	TOP CAP
V1	6J7	TP	390Ω	†500K	†2.2meg	2700Ω	NC	390Ω	2700Ω	1meg
V2	6SL7GT	1meg	†100K	1500Ω	0Ω	†240K	2700Ω	390Ω	390Ω	
V3	6V6GT	NC	390Ω	†560Ω	†6800Ω	270K ■100K	TP	390Ω	390Ω	
V4	6X5GT	TP	390Ω	360Ω	TP	560Ω	TP	390Ω	¶	

ALL MEASUREMENTS TAKEN IN "PLAY" POSITION UNLESS OTHERWISE DESIGNATED
† MEASURED FROM PIN 8 OF V4
■ MEASURED IN "RECORD" POSITION
¶ THIS READING WILL VARY DEPENDING UPON THE CONDITION OF THE ELECTROLYTIC CAPACITOR CONNECTED IN THE ASSOCIATED CIRCUIT.
NC NO CONNECTION
TP TIE POINT

⊖ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

DC COIL RESISTANCE VALUES UNDER ONE OHM NOT SHOWN ON SCHEMATIC DIAGRAM

ARROWS ON CONTROLS INDICATE CLOCKWISE ROTATION (CONTROL VIEWED FROM SHAFT END)

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

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Figure 14. Schematic Diagram Of Model NL-1.

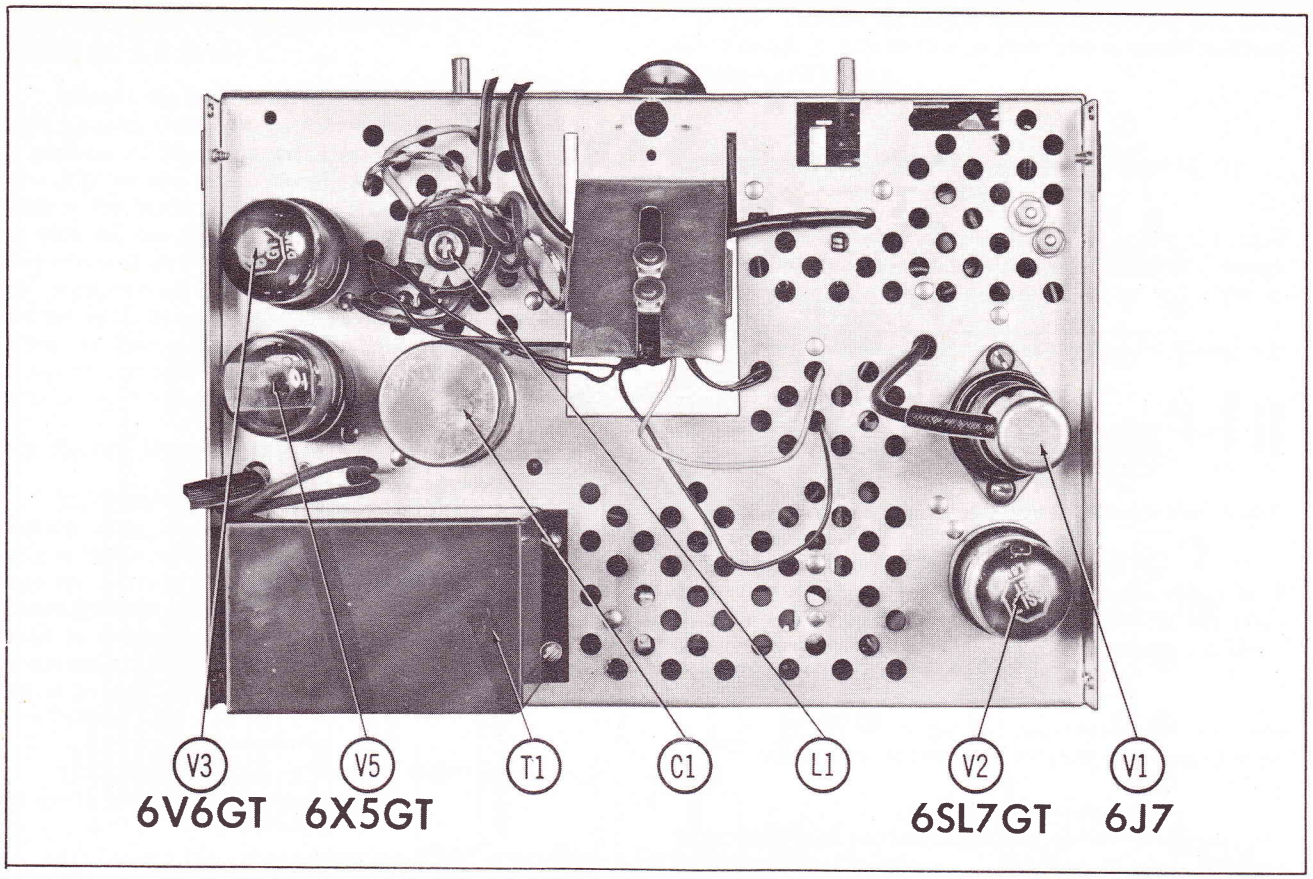


Figure 15. Rear View Of NL-2 Amplifier.

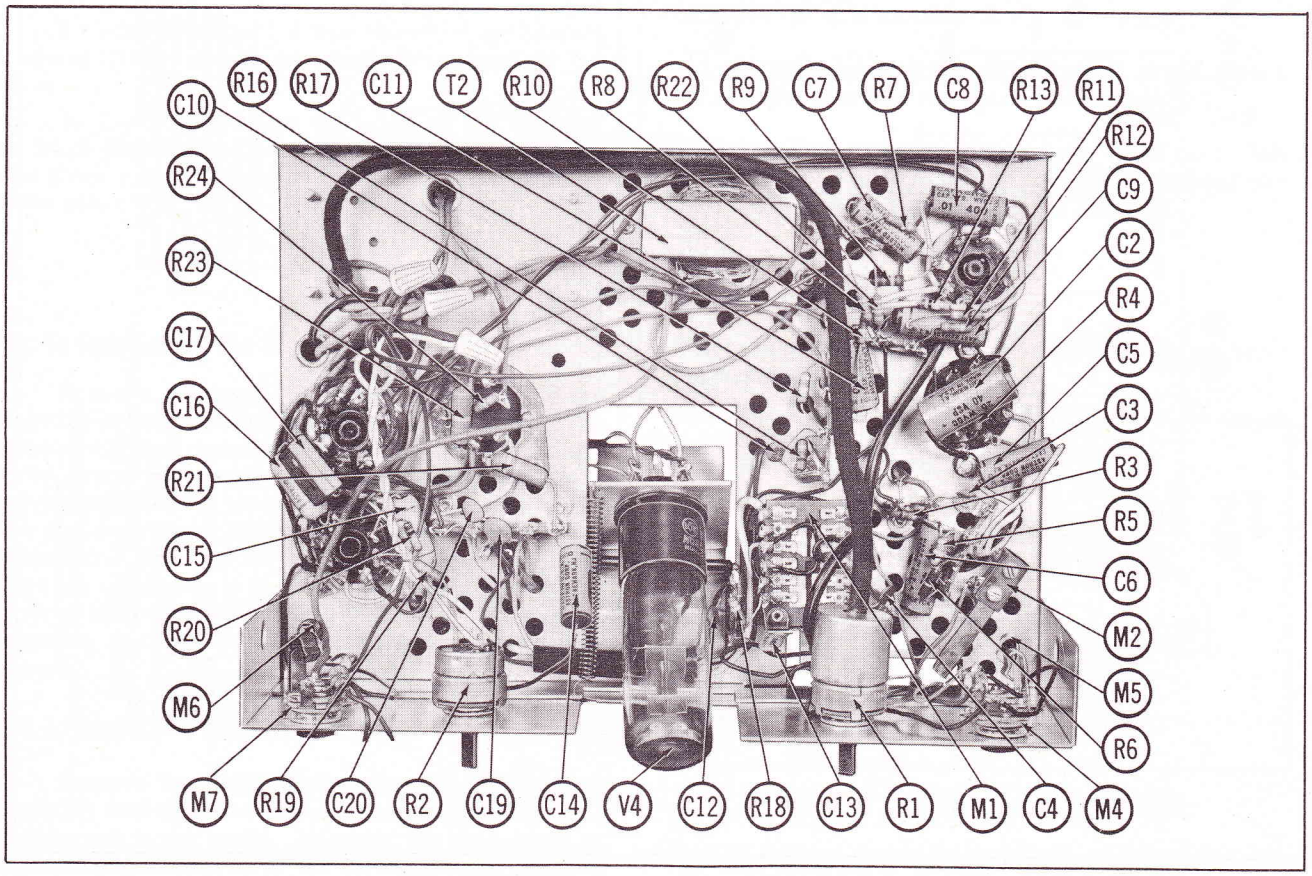
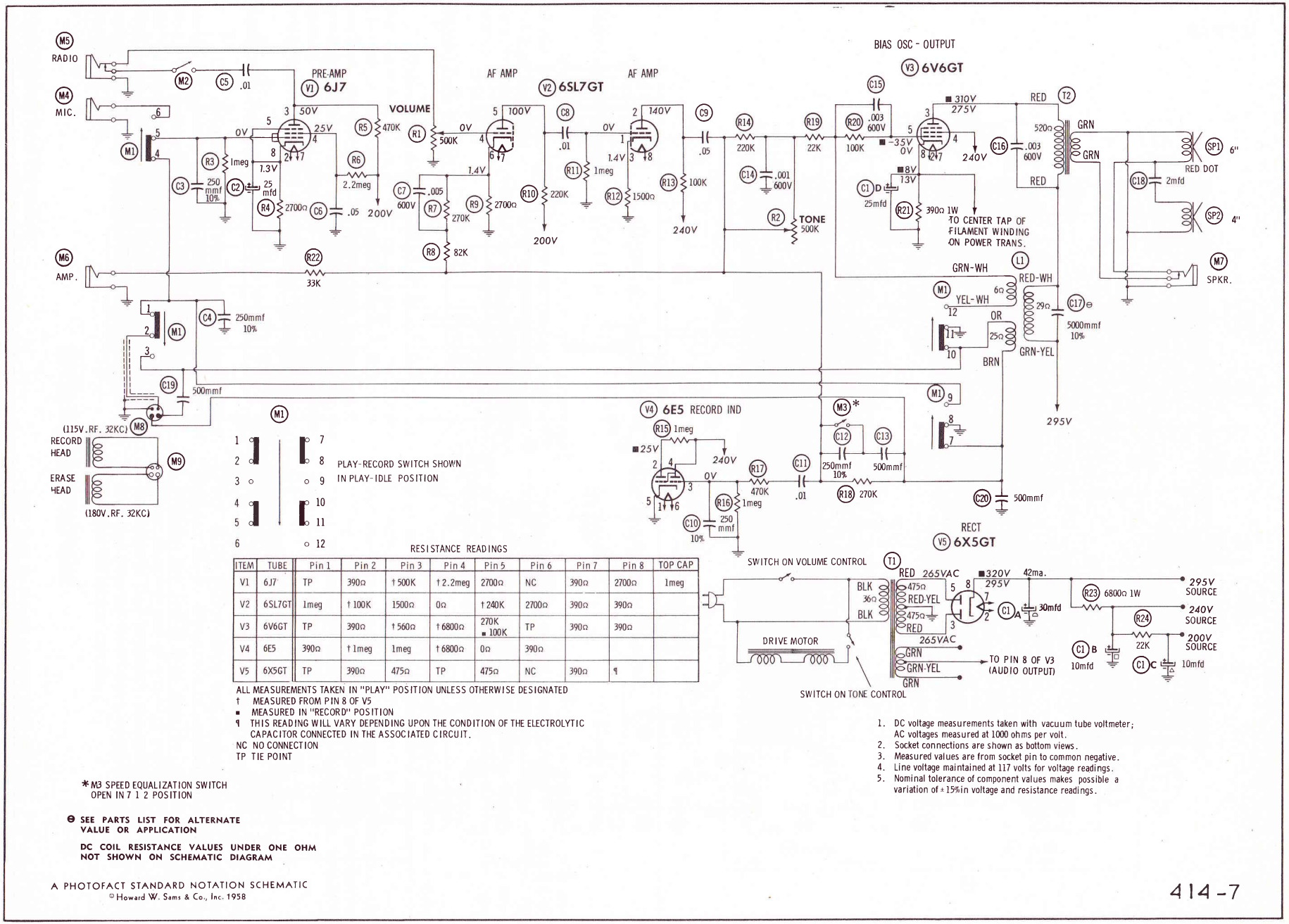


Figure 16. Front View Of NL-2 Amplifier.



RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	TOP CAP
V1	6J7	TP	390Ω	†500K	†2.2meg	2700Ω	NC	390Ω	2700Ω	1meg
V2	6SL7GT	1meg	†100K	1500Ω	0Ω	†240K	2700Ω	390Ω	390Ω	
V3	6V6GT	TP	390Ω	†560Ω	†6800Ω	270K ▪ 100K	TP	390Ω	390Ω	
V4	6E5	390Ω	†1meg	1meg	†6800Ω	0Ω	390Ω			
V5	6X5GT	TP	390Ω	475Ω	TP	475Ω	NC	390Ω	¶	

ALL MEASUREMENTS TAKEN IN "PLAY" POSITION UNLESS OTHERWISE DESIGNATED
† MEASURED FROM PIN 8 OF V5
▪ MEASURED IN "RECORD" POSITION
¶ THIS READING WILL VARY DEPENDING UPON THE CONDITION OF THE ELECTROLYTIC CAPACITOR CONNECTED IN THE ASSOCIATED CIRCUIT.
NC NO CONNECTION
TP TIE POINT

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.

*M3 SPEED EQUALIZATION SWITCH OPEN IN 7 1 2 POSITION

Θ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

DC COIL RESISTANCE VALUES UNDER ONE OHM NOT SHOWN ON SCHEMATIC DIAGRAM

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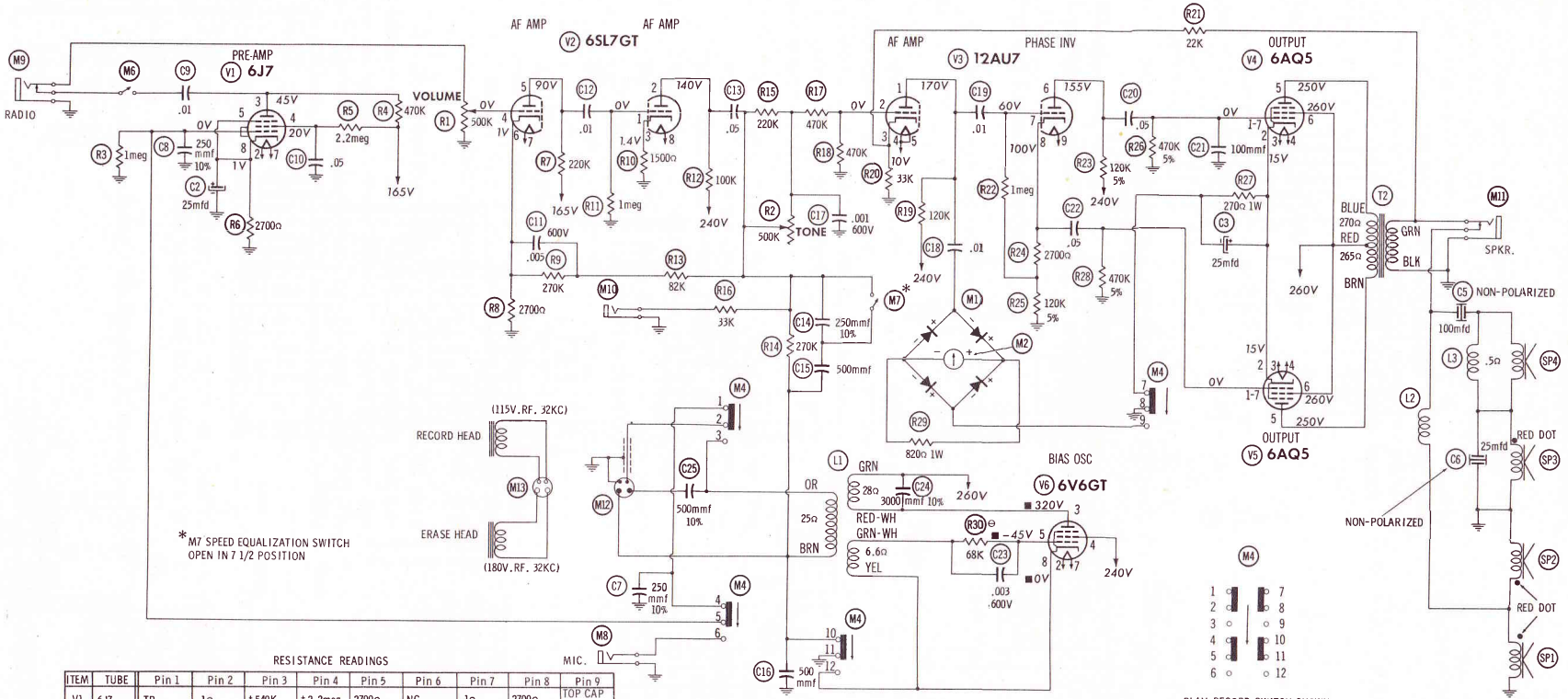
Figure 17. Schematic Diagram Of Model NL-2.



RESISTANCE READINGS

ITEM	TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1	6J7	TP	.1Ω	†540K	†2.2meg	2700Ω	NC	.1Ω	2700Ω	TOP CAP 1meg
V2	6SL7GT	1meg	†100K	1500Ω	0Ω	†290K	2700Ω	.1Ω	.1Ω	
V3	12AU7A	†120K	470K	13K	.1Ω	.1Ω	†120K	1.1meg	120K	.1Ω
V4	6AQ5	470K	270Ω	.1Ω	.1Ω	†920Ω	†750Ω	470K		
V5	6AQ5	470K	270Ω	.1Ω	.1Ω	†915Ω	†750Ω	470K		
V6	6V6GT	TP	.1Ω	†780Ω	†1600Ω	INF ■ 68K	TP	.1Ω	INF ■ 0Ω	
V7	6X5GT	TP	.1Ω	160Ω	TP	180Ω	TP	.1Ω	¶	

ALL MEASUREMENTS TAKEN IN "PLAY" POSITION UNLESS OTHERWISE DESIGNATED
† MEASURED FROM PIN 8 OF V7
■ MEASURED IN "RECORD" POSITION
▲ MEASURED FROM PIN 8 OF V3
¶ THIS READING WILL VARY DEPENDING UPON THE CONDITION OF THE ELECTROLYTIC CAPACITOR CONNECTED IN THE ASSOCIATED CIRCUIT.
NC NO CONNECTION
TP TIE POINT

Θ SEE PARTS LIST FOR ALTERNATE VALUE OR APPLICATION

DC COIL RESISTANCE VALUES UNDER ONE OHM NOT SHOWN ON SCHEMATIC DIAGRAM

1. DC voltage measurements taken with vacuum tube voltmeter; AC voltages measured at 1000 ohms per volt.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative.
4. Line voltage maintained at 117 volts for voltage readings.
5. Nominal tolerance of component values makes possible a variation of ±15% in voltage and resistance readings.
6. All controls at minimum, proper output load connected.

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Figure 18. Schematic Diagram Of Model NL-3.

PARTS LIST AND DESCRIPTIONS
PRE-AMP

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Pre-Amp	12AX7	

ITEM No.	USE	TYPE	NOTES

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT.	PENTRON PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1	25	25	273-25614	PRS25V25	BBR25-25	TC36	TD-25-25	MT-0225	TVA-1205

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA						NOTES
	CAP.	VOLT	PENTRON PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.	
C2	10000		227-10342	BPD-01	DD-103	BYA10S1	DC511	5HK-S1	
C3	3000		263-3024	BPD-003	DD-302	BYA10D3	UC-523	5HK-D3	
C4	.05	400	263-50342	P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		PENTRON PART No.	NOTES
	OHMS	WATT		
R1	1meg		111-10521	
R2	2700Ω		111-27221	
R3	220K		111-22421	
R4	1meg		111-10521	

ITEM No.	RATING		PENTRON PART No.	NOTES
	OHMS	WATT		
R5	470K		111-47421	
R6	150K		111-15421	
R7	1500Ω		111-15221	
R8	100K		111-10421	

PARTS LIST AND DESCRIPTIONS AMP NL-1

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Pre-Amp	6J7	
V2	AF Amp	6SL7GT	

ITEM No.	USE	TYPE	NOTES
V3	Bias-Osc-Output	6V6GT	
V4	Rectifier	6X5GT	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT.	PENTRON PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	● 30	350	285-50644	AFH4-68	D0390	FP457	TMQ-53	Q-330	R2711 *
B	■ 10	350			BR2035		TD-10-450	MT-4520	
C	▲ 10	350							
D	25	25	①						
C2	25	25	273-25614	PRS25V25	BBR25-25	TC36	TD-25-25	MT-0225	TVA-1205

①Not used in this application

* Non-Catalog Item

PARTS LIST AND DESCRIPTIONS (Continued)

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA						NOTES
	CAP.	VOLT	PENTRON PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.	
C3	250		227-25151		MD-251	L10T25			10%
C4	250		227-25151		MD-251	L10T25			10%
C5	.05	400	263-50342	P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	
C6	.01	400	263-10342	P488N-01	D6-103	CUB4S1	GEM-411	4TM-S1	
C7	.005	600	263-50262	P688N-005	D6-502	CUB6D5	GEM-625	6TM-D5	
C8	.01	400	263-10342	P488N-01	D6-103	CUB4S1	GEM-411	4TM-S1	
C9	.05	400	263-50342	P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	
C10	250		227-25151		MD-251	L10T25			10%
C11	.01	400	263-10342	P488N-01	D6-103	CUB4S1	GEM-411	4TM-S1	
C12	250		227-25151		MD-251	L10T25			10%
C13	500		227-50152	BPD-0005	DD-501	L10T5	UC-535	5GA-T5	
C14	.001	600	263-10262	P688N-001	D6-102	CUB6D1	GEM-625	6TM-D1	
C15	.003	600	263-30262	P688N-003	D6-302	CUB6D3	GEM-623	6TM-D3	
C16	.003	600	263-30262	P688N-003	D6-302	CUB6D3	GEM-623	6TM-D3	
C17	3000		232-30241	1464-003		1R5D3	MCB461	MS-23	10%
C18	680		227-68151		MD-681				10%
C19	500		227-50152	BPD-0005	DD-501	L10T5	UC-535	5GA-T5	

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	PENTRON PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	500K	1/2	124-50413-7	B-60	A47-500K-Z	Q13-133	U48	Volume
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
R2A	500K	1/2	126-50413-4	B-60	A47-500K-Z	Q13-133	U48	Tone
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
C	Switch			KB-1 or KR-1*	SWE-12	76-1	US-26	On-Off
R3A	500K	1/2	129-50413	B-59	B47-500K-S	B11-133	PTA55L	Record Level Indicator Adj.
B	Shaft			Not Req.	SK2	SK2	Not Req.	

* Use KR-1 with CRL "Red Label" controls and KB-1 with "Blue Label" controls.

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		PENTRON PART No.	NOTES
	OHMS	WATT		
R4	1meg		111-10521	
R5	2700Ω		111-27221	
R6	470K		111-47421	
R7	2.2meg		111-22521	
R8	33K		111-33321	
R9	270K		111-27421	
R10	2700Ω		111-27221	
R11	82K		111-82321	
R12	220K		111-22421	
R13	1meg		111-10521	
R14	1500Ω		111-15221	

ITEM No.	RATING		PENTRON PART No.	NOTES
	OHMS	WATT		
R15	100K		111-10421	
R16	100K		111-10421	
R17	820K		111-82421	
R18	220K		111-22421	
R19	22K		111-22321	
R20	270K		111-27421	
R21	100K		111-10421	
R22	390Ω	1	111-39131	
R23	6800Ω	1	111-68231	
R24	22K		111-22321	

TRANSFORMER (POWER)

ITEM No.	RATING			REPLACEMENT DATA						
	PRI.	SEC. 1	SEC. 2	PENTRON PART No.	Halldorson PART No.	Merit PART No.	Ram PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC @ .275A	480VCT @ .040A	6.3VCT @ 1.5A	352A-28	P9210	P-3147		PC8418	24R11U	R-4A①

①Drill New Mounting Holes.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA							NOTES
	PRI.	SEC.	PENTRON PART No.	Halldorson PART No.	Merit PART No.	Ram PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T2	5800Ω	3-4Ω	342-12	Z1007	A-3019	AU-600	A-3849	26S49	S-5Z	

PENTRON MODELS NL-1, -1S, NL-2, -2S, NL-3, -3S, TM-1, -4

PARTS LIST AND DESCRIPTIONS (Continued)

COIL

ITEM No.	USE	REPLACEMENT DATA PENTRON PART No.	Meissner PART No.	Merit PART No.	Miller PART No.	Ram PART No.	NOTES
L1	Bias Osc.	311A-13					

SPEAKER

ITEM No.	TYPE SIZE	FIELD	V. C. IMP.	REPLACEMENT DATA PENTRON PART No.	QUAM PART No.	NOTES
SP1	6"	PM	3-4Ω	345B-19	6A1	

MISCELLANEOUS

ITEM No.	PART NAME	PENTRON PART No.	NOTES
M1	Lamp	423A-2	NE51
M2	Switch	534A-3	Play-Record (Slide Type)
M3	Switch	532A-6	Pre-Amp. Muting (SPST Leaf Type)
M4	Jack	552A-13	Mic.
M5	Jack	552-6	Radio
M6	Jack	552-6	Amp.
M7	Jack	552-6	Spkr.
M8	Plug	564-2	Four Pin
M9	Socket	554A-3	Four Pin

WIRING DATA

General-use Unshielded Hook-up Wire ..... Use BELDEN No. 8530 (Solid) Available in Ten Colors
8524 (Stranded) Available in Ten Colors
Power Cord ..... Use BELDEN No. 1765-B (6 Ft. Length)
1725-K (7½ Ft. Length)
Low-Loss Shielded Lead (Interconnecting) .....Use BELDEN No. 8401
Phono Pick-up Arm Cable ..... Use BELDEN No. 8430 (Two Conductor - Twisted)

PARTS LIST AND DESCRIPTIONS AMP NL-2

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Pre-Amp	6J7	
V2	AF Amp	6SL7GT	
V3	Bias-Osc-Output	6V6GT	
V4	Record Ind.	6E5	
V5	Rectifier	6X5GT	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING CAP.	VOLT.	REPLACEMENT DATA PENTRON PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▰30	350	285-50644	AFH4-68	D0390	FP457	TMQ-53	Q-330	R2711*
B	■10	350			BR2035		TD-10-450	MT-4520	
C	▲10	350							
D	25	25							
C2	25	25	273-25614	PRS25V25	BBR25-25	TC36	TD-25-25	MT-0225	TVA-1205

* Non-Catalog Item

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP.	VOLT	REPLACEMENT DATA PENTRON PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C3	250		227-25151		MD-251	L10T25			10%
C4	250		227-25151		MD-251	L10T25			10%
C5	.01	400	263-10342	P488N-01	D6-103	CUB4S1	GEM-411	4TM-S1	
C6	.05	400	263-50342	P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	

PARTS LIST AND DESCRIPTIONS (Continued)

CAPACITORS (cont)

ITEM No.	RATING CAP.	VOLT	REPLACEMENT DATA PENTRON PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.	NOTES
C7	.005	600	263-50262	P688N-005	D6-502	CUB6D5	GEM-625	6TM-D5	
C8	.01	400	263-10342	P488N-01	D6-103	CUB4S1	GEM-411	4TM-S1	
C9	.05	400	263-50342	P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	
C10	250		227-25151		MD-251	L10T25			10%
C11	.01	400	263-10342	P488N-01	D6-103	CUB4S1	GEM-411	4TM-S1	
C12	250		227-25151		MD-251	L10T25			10%
C13	500		227-50152	BPD-0005	DD-501	L10T5	UC-535	5GA-T5	
C14	.001	600	263-10262	P688N-001	D6-102	CUB6D1	GEM-625	6TM-D1	
C15	.003	600	263-30262	P688N-003	D6-302	CUB6D3	GEM-623	6TM-D3	
C16	.003	600	263-30262	P688N-003	D6-302	CUB6D3	GEM-623	6TM-D3	
C17	5000		232-50242	1464-005		IDR5D5	MCB465	MS-25	10% ①
C18	2.	50	263-20513						
C19	500		227-50152	BPD-0005	DD-501	L10T5	UC-535	5GA-T5	
C20	500		227-50152	BPD-0005	DD-501	L10T5	UC-535	5GA-T5	

①Some versions may use 3000mmf in this application (Part #232-3024l).

CONTROLS

ITEM No.	RATING RESIST-ANCE	WATTS	REPLACEMENT DATA PENTRON PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	INSTALLATION NOTES
R1A	500K	½	126-50413-4	B-60	A47-500K-Z	Q13-133	U48	Volume
B	Shaft			Not Req	FS-3	Not Req.	Not Req.	
C	Switch			KB-1 or KR-1*	SWE-12	76-1	US-26	On-Off
R2A	500K	½	126-50413-4	B-60	A47-500K-Z	Q13-133	U48	Tone
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
C	Switch			KB-1 or KR-1*	SWE-12	76-1	US-26	Motor On-Off

* Use KR-1 with CRL "Red Label" controls and KB-1 with "Blue Label" controls.

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING OHMS	WATT	PENTRON PART No.	NOTES
R3	1meg		111-10521	
R4	2700Ω		111-27221	
R5	470K		111-47421	
R6	2.2meg		111-22521	
R7	270K		111-27421	
R8	82K		111-82321	
R9	2700Ω		111-27221	
R10	220K		111-22421	
R11	1meg		111-10521	
R12	1500Ω		111-15221	
R13	100K		111-10421	
R14	220K		111-22421	
R15	1meg		111-10521	
R16	1meg		111-10521	
R17	470K		111-47421	
R18	270K		111-27421	
R19	22K		111-22321	
R20	100K		111-10421	
R21	390Ω	1	111-39131	
R22	33K		111-33321	
R23	6800Ω	1	111-68231	
R24	22K		111-22321	

TRANSFORMER (POWER)

ITEM No.	RATING PRI.	SEC. 1	SEC. 2	REPLACEMENT DATA PENTRON PART No.	Halldorson PART No.	Merit PART No.	Ram PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC @ .33A	530VCT @ .042A	6.3VCT @1.84A	352A-17					25R02①	

①Drill New Mounting Hole.

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE PRI.	SEC.	REPLACEMENT DATA PENTRON PART No.	Halldorson PART No.	Merit PART No.	Ram PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	NOTES
T2	5800Ω	2-3Ω	342-12	Z1007	A-3019	AU-600	A-3849	26S49	S-5Z	

COILS

ITEM No.	USE	REPLACEMENT DATA PENTRON PART No.	Meissner PART No.	Merit PART No.	Miller PART No.	Ram PART No.	NOTES
L1	Bias Osc.	311A-13					

PARTS LIST AND DESCRIPTIONS (Continued)

SPEAKER

ITEM No.	TYPE			REPLACEMENT DATA		NOTES
	SIZE	FIELD	V. C. IMP.	PENTRON PART No.	QUAM PART No.	
SP1	6"	PM	3-4Ω	345B-19	6A1	
SP2	4"	PM	3-4Ω	345-18	4A07	

MISCELLANEOUS

ITEM No.	PART NAME	PENTRON PART No.	NOTES
M1	Switch	534A-3	Play-Record (Slide Type)
M2	Switch	532A-6	Pre-Amp Muting (SPST Leaf Type)
M3	Switch	532A-6	Speed Equalization (SPST Leaf Type)
M4	Jack	552A-13	Mic.
M5	Jack	552-1	Radio
M6	Jack	552A-13	Amp.
M7	Jack	552-1	Spkr.
M8	Plug	564-2	Four Pin
M9	Socket	554A-3	Four Pin

WIRING DATA

General-use Unshielded Hook-up Wire ..... Use BELDEN No. 8530 (Solid) Available in Ten Colors
8524 (Stranded) Available in Ten Colors

Power Cord ..... Use BELDEN No. 1765-B (6 Ft. Length)
1725-K (7½ Ft. Length)

Low-Loss Shielded Lead (Interconnecting) ..... Use BELDEN No. 8401

Phono Pick-up Arm Cable ..... Use BELDEN No. 8430 (Two Conductor - Twisted)

PARTS LIST AND DESCRIPTIONS AMP NL-3

TUBES (GENERAL ELECTRIC, SYLVANIA)

ITEM No.	USE	TYPE	NOTES
V1	Pre-Amp	6J7	
V2	AF Amp	6SL7GT	
V3	AF Amp-Phase Inv.	12AU7A	
V4	Output	6AQ5	
V5	Output	6AQ5	
V6	Bias Osc.	6V6GT	

ELECTROLYTIC CAPACITORS

ITEM No.	RATING		REPLACEMENT DATA						
	CAP.	VOLT.	PENTRON PART No.	AEROVOX PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	PYRAMID PART No.	SANGAMO PART No.	SPRAGUE PART No.
C1A	▲40	450	285-90694	AFH4-18-10	D0171	FP446	TMQ-18	Q-060	TVL-4771.8
B	■30	450					TD-10-450	MT-4510	
C	▲10	350							
D	10	350							
C2	25	25	273-25614	PRS25V25	BBR25-25	TC36	TD-25-25	MT-0225	TVA-1205
C3	25	25	273-25614	PRS25V25	BBR25-25	TC36	TD-25-25	MT-0225	TVA-1205
C4	100	6	273-10796	PRS6V100	BBR100-6	TT6X100	TD-100-6	MTH-0610	TVA-1101
C5	100	50NP	293-10713		BR20015 †		†TD-200-150		R2710*
					BR20015 †		TD-200-150		
C6	25	50NP	293-25613		BR505 †	TC39 †	TD-50-50†	MT-0550 †	R2709*
					BR505 †	TC39 †	TD-50-50†	MT-0550 †	

† Connect Negative Leads Together

* Non-Catalog Item

FIXED CAPACITORS

Capacity values given in the rating column are in mfd. for Paper Capacitors, and in mmfd. for Mica and Ceramic Capacitors.

ITEM No.	RATING		REPLACEMENT DATA						NOTES
	CAP.	VOLT	PENTRON PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.	
C7	250		227-25151		MD-251	L10T25			10%
C8	250		227-25151		MD-251	L10T25			10%
C9	.01	400	263-10342	P488N-01	D6-103	CUB4S1	GEM-411	4TM-S1	

PARTS LIST & DESCRIPTION (continued)

CAPACITORS (cont)

ITEM No.	RATING		REPLACEMENT DATA						NOTES
	CAP.	VOLT	PENTRON PART No.	AEROVOX PART No.	CENTRALAB PART No.	CORNELL-DUBILIER PART No.	MALLORY PART No.	SPRAGUE PART No.	
C10	.05	400	263-50342	P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	
C11	.005	600	263-50262	P688N-005	D6-502	CUB6D5	GEM-625	6TM-D5	
C12	.01	400	263-10342	P488N-01	D6-103	CUB4S1	GEM-411	4TM-S1	
C13	.05	400	263-50342	P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	
C14	250		227-25151		MD-251	L10T25			10%
C15	500		227-50152	BPD-0005	DD-501	L10T5	UC-535	5GA-T5	
C16	500		227-50152	BPD-0005	DD-501	L10T5	UC-535	5GA-T5	
C17	.001	600	263-10262	P686N-001	D6-102	CUB6D1	GEM-621	6TM-D1	
C18	.01	400	263-10342	P488N-01	D6-103	CUB4S1	GEM-411	4TM-S1	
C19	.01	400	263-10342	P488N-01	D6-103	CUB4S1	GEM-411	4TM-S1	
C20	.05	400	263-50342	P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	
C21	100		232-10152	1468-0001	DD-101	22R5T1	MC235	1FM-31	
C22	.05	400	263-50342	P488N-05	DF-503	CUB4S5	GEM-415	4TM-S5	
C23	.003	600	263-30262	P688N-003	D6-302	CUB6D3	GEM-623	6TM-D3	
C24	3000		232-30241	1464-003		1R5D3	MCB463	MS-23	10%
C25	500		232-50151	1469-0005	MD-501	5R5T5	MCB245	MS-35	10%

CONTROLS

ITEM No.	RATING		REPLACEMENT DATA					INSTALLATION NOTES
	RESISTANCE	WATTS	PENTRON PART No.	CENTRALAB PART No.	CLAROSTAT PART No.	IRC PART No.	MALLORY PART No.	
R1A	500K	½	126-50413-4	B-60	A47-500K-Z	Q13-133	U48	Volume
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
C	Switch			KB-1 or KR-1*	SWE-12	76-1	US-26	On-Off
R2A	500K	½	126-50413-4	B-60	A47-500K-Z	Q13-133	U48	Tone
B	Shaft			Not Req.	FS-3	Not Req.	Not Req.	
C	Switch			KB-1 or KR-1*	SWE-12	76-1	US-26	Relay

* Use KR-1 with CRL "Red Label" controls and KB-1 with "Blue Label" controls.

RESISTORS

All wattages 1/2 watt, or less, unless otherwise listed.

ITEM No.	RATING		PENTRON PART No.	NOTES
	OHMS	WATT		
R3	1meg		111-10521	
R4	470K		111-47421	
R5	2.2meg		111-22521	
R6	2700Ω		111-27221	
R7	220K		111-22421	
R8	2700Ω		111-22721	
R9	270K		111-22421	
R10	82K		111-82321	
R11	1meg		111-10521	
R12	100K		111-10421	
R13	1500Ω		111-15221	
R14	270K		111-27421	
R15	220K		111-22421	
R16	33K		111-33321	
R17	470K		111-47421	
R18	470K		111-47421	
R19	120K		111-12421	
R20	33K		111-33321	
R21	22K		111-22321	
R22	1meg		111-10521	
R23	120K 5%		111-12425	
R24	2700Ω		111-27221	
R25	120K 5%		111-12425	
R26	470K 5%		111-47425	
R27	270Ω	1	111-27131	
R28	470K 5%		111-47425	
R29	820Ω	1	111-82132	
R30	68K		111-68321	Note 1
R31	750Ω	7	151-75191	
R32	820Ω	1	111-82132	
R33	68K	1	111-68332	

Note 1. Some versions may use 47K in this application (Part # 111-47321).

TRANSFORMER (POWER)

ITEM No.	RATING			REPLACEMENT DATA						
	PRI.	SEC. 1	SEC. 2	PENTRON PART No.	Halldorson PART No.	Merit PART No.	Ram PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
T1	117VAC @ .5A	575VCT @ .070A	6.3VCT @ 2.8A	352-33					22R02①	

① Fabricate Mounting

PENTRON MODELS NL-1, -1S, NL-2, -2S, NL-3, -3S, TM-1, -4

PARTS LIST AND DESCRIPTIONS (Continued)

TRANSFORMER (AUDIO OUTPUT)

ITEM No.	IMPEDANCE		REPLACEMENT DATA							NOTES
	PRI.	SEC.	PENTRON PART No.	Halldorson PART No.	Merit PART No.	Ram PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.	
T2	7000Ω CT	3-4Ω	342A-19	Z1009 ①	A-2901	AU-606	A-3870	22S58	S-55X	①Drill New Mounting Hole.

COILS (RF-IF)

ITEM No.	USE	REPLACEMENT DATA					
		PENTRON PART No.	Meissner PART No.	Merit PART No.	Miller PART No.	Ram PART No.	NOTES
L1	Bias Osc.	311A-13					
L2	Speaker Choke	341A-2					

CHOKE

ITEM No.	RATINGS			REPLACEMENT DATA						
	CURRENT (Measured)	DC RES.	INDUCTANCE (0 CURRENT 1000 ∿)	PENTRON PART No.	Halldorson PART No.	Merit PART No.	Ram PART No.	Stancor PART No.	Thordarson PART No.	Triad PART No.
L3		.5Ω	430MMH	Part of SP4						

SPEAKER

ITEM No.	TYPE			REPLACEMENT DATA		NOTES
	SIZE	FIELD	V. C. IMP.	PENTRON PART No.	QUAM PART No.	
SP1	6"	PM	3-4Ω	345-15	6A1	① Part # Includes (L3)
SP2	6"	PM	3-4Ω	345-15	6A1	
SP3	6"	PM	3-4Ω	345B-19	6A1	
SP4	4"	PM	4-5Ω	345-21①	4A1TZ4.2	

SELENIUM RECTIFIER

ITEM No.	RATING	REPLACEMENT DATA				NOTES
	CURRENT (Measured)	PENTRON PART No.	FEDERAL PART No.	INTERNATIONAL PART No.	SARKES TARZIAN PART No.	
M1		454-9		60-8694		

MISCELLANEOUS

ITEM No.	PART NAME	PENTRON PART No.	NOTES
M2	Meter	478A-5	Record Level
M3	Lamp	422-51	#47
M4	Switch	534A-3	Play-Record (Slide Type)
M5	Relay	534A-15	Drive Motor
M6	Switch	532A-6	Pre-Amp. Muting (SPST Leaf Type)
M7	Switch	532A-6	Speed Equalization (SPST Leaf Type)
M8	Jack	552A-13	Mic.
M9	Jack	552-1	Radio
M10	Jack	552A-13	Amp.
M11	Jack	552-1	Spkr.
M12	Plug	564-2	Four Pin
M13	Socket	554A-3	Four Pin

CABINETS & CABINET PARTS

(When Ordering Cabinets & Cabinet Parts, Specify Model, Chassis & Color)

NAME	PART NO.	DESCRIPTION
Knob	824B-17-1	Control, Gray
Knob	824B-17-2	Control, Brown
Knob	714A-276	Speed Shift Lever
Cover	964D-90	Top Casting (Includes Trim Plate Assembly)Model NL-1
Cover	964A-371	Top Casting (Includes Trim Plate Assembly)Model NL-2
Cover	964A-372	Top Casting (Includes Trim Plate Assembly)Model NL-3
Panel	711A-708	Top Cover, Model NL-1
Panel	711D-62	Top Cover, Model NL-2
Panel	711D-64	Top Cover, Model NL-3

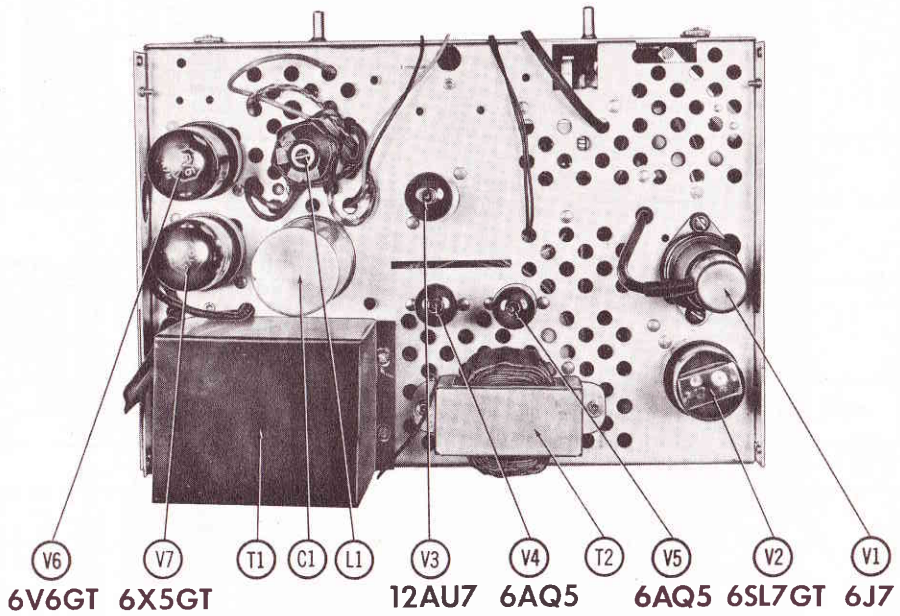
PARTS LIST & DESCRIPTION (continued)

WIRING DATA

General-use Unshielded Hook-up Wire	Use BELDEN No. 8530 (Solid) Available in Ten Colors 8524 (Stranded) Available in Ten Colors
Power Cord	Use BELDEN No. 1765-B (6 Ft. Length) 1725-K (7½ Ft. Length)
Low-Loss Shielded Lead (Interconnecting)	Use BELDEN No. 8401
Phono Pick-up Arm Cable	Use BELDEN No. 8430 (Two Conductor - Twisted)

CHASSIS—REAR VIEW

NL-3



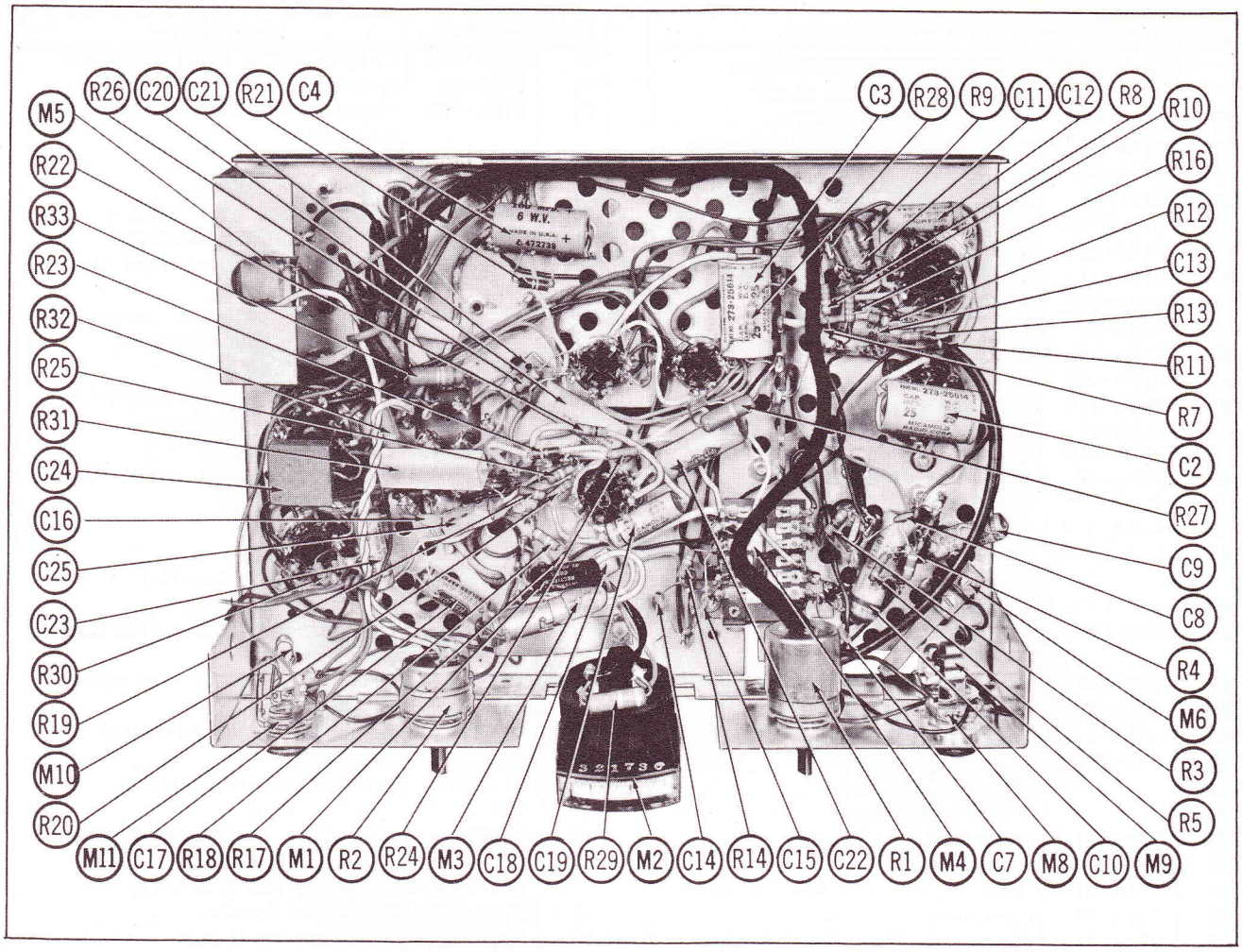


Figure 19. Front View Of NL-3 Amplifier.

MECHANICAL PARTS LIST

Ref. No.	Part No.	Description
1	714A-276-1	Reel Spindle Cap (Gray)
	714A-276-2	Reel Spindle Cap (Brown)
2	765B-12-1	Reel Rest (Gray)
	765B-12-2	Reel Rest (Brown)
3	824B-17-1	Control Knob (Gray)
	824B-17-2	Control Knob (Brown)
4	714A-276	Speed Shift Lever Knob
5	824B-13-1	Head Cover Casting (Gray)
	824B-13-2	Head Cover Casting (Brown)
6	611-61633	#6-32 x 1 Phillips O.H.M.S.
7	964A-374	Top Cover Casting & Trim Plate Ass'y. (Model TM-1)
	964D-90	Top Cover Casting & Trim Plate Ass'y. (Model NL-1)
	964A-371	Top Cover Casting & Trim Plate Ass'y. (Model NL-2)
	964A-372	Top Cover Casting & Trim Plate Ass'y. (Model NL-3) (Ref. No. 7 Includes Items 7A, 7B, 7C, & 7D)
7A	761D-47	Top Trim Plate (Model TM-1)
	761D-49	Top Trim Plate (Model NL-1)
	761D-48	Top Trim Plate (Model NL-2)
	761A-90	Top Trim Plate (Model NL-3)

Ref. No.	Part No.	Description
7B	824D-2-1	Top Cover Casting (Gray)
	824D-2-2	Top Cover Casting (Brown)
7C	619-48	Escutcheon Drive Pin
7D	711A-498	Cover Clip
8	532A-40	Motor On-Off Switch (Model TM-1)
9	612-60464	#6-32 x 1/4 Hex. Hd. Self Tap. Screw
10	711D-62	Top Cover Panel (Model TM-1)
	711A-708	Top Cover Panel (Model NL-1)
	711D-62	Top Cover Panel (Model NL-2)
	711D-64	Top Cover Panel (Model NL-3)
11	963C-11	Head Assembly (Models TM-1, NL-1, NL-2, & NL-3)
11A	964C-56	Record-Playback Head
11B	964B-132	Record-Playback Pole Piece
11C	964C-57	Double Gap Erase Head
11D	964B-134	Double Gap Erase Pole Piece
12	963C-12	Stacked Stereo And Double Gap Erase Head Assembly (Models TM-4, NL-1S, NL-2S, & NL-3S)
12A	983A-8	Stacked Stereo Head
	964C-54	Combination Record-Play-Erase Head (Used in early production for Models TM-1 & NL-1. Not shown on exploded view.)

FOLDER 7

Ref. No.	Part No.	Description
	964B-90	Pole Piece (For combination Record-Play-Erase Head)
13	611-80344	#8-32 x 3/16 F.H.M.S.
14	964A-335	Pressure Plate & Pad Assembly
14A	871A-22	Felt Pressure Pad
14B	619-144	.125 Crescent Retaining Ring
15	611-20314	#2-56 x 3/16 R.H.M.S.
16	964A-334	Carrier Bracket Assembly
17	813A-11	Stud, Phenolic Rod
18	964A-333	Carrier Plate Assembly
19	742A-35	Cut-Off Switch Spring
20	813A-10	Spacer
21	619A-148	.25 Crescent Retaining Ring
22	964A-116	Capstan Pressure Roller
22A	714A-47	Capstan Pressure Roller Shaft
23	616A-3169	.25 x .5 x .01 Clock Steel Washer
24	764A-78	Speed Change Shaft Knob
25	711A-707	Speed Change Sector
26	964A-339	Speed Shift Lever Assembly
27	613-10896	#10-32 x 1/2 Socket Hd. Mtg. Screw
28	617-1134	#10 Ext. Tooth Lockwasher
29	616-1144	.203 x .438 x .031 Flat Steel Washer
30	619-146	3/16" Crescent Retaining Ring
31	616A-24	.19 x .38 x .01 Clock Steel Washer
32	498A-2	Counter (Models NL-2 & NL-3)
33	814-59	Record Lock Button
34		#4-40 x 1 R.H.M.S.
35		Flat Washer, Steel
36	734A-31	Tape-Post
37	964A-114	Pressure Pad Carrier Assembly
38	616A-3169	.25 x .5 x .01 Clock Steel Washer
39	712A-78	Compression Spring
40	964A-340	Mechanism Plate Rivet Ass'y. (Model TM-1)
	964D-35	Mechanism Plate Rivet Ass'y. (Model NL-1 & NL-2)
	964A-347	Mechanism Plate Rivet Ass'y. (Model NL-3)
40A	964A-268	Control Assembly
41	711A-709	Rocker Arm
42	964B-130	Play & Record Control Cam Ass'y.
43	964A-23	Slide Plate Assembly
44	711A-330	Pressure Arm Lever
45	614-6084	#6-32 Hex. Nut (Some Models use screw part # 613-60464 in this application)
46	712A-75	Pressure Finger Spring
47	711B-164	Wind & Rewind Slide Plate
48	964C-51	Idler Release Lever Assembly
49	964B-131	Control Shaft Assembly
50	619A-47	Detent Spring
51	711B-161	Brake Clip
52	616-8124	.16 x .38 x .03 Flat Steel Washer
53	611-60454	#6-32 x 1/4 B.H.M.S.
54	711A-720	Take-up Adj. Lever
55	964A-338	Spring Ring Assembly
56	712A-80	Idler Lever Spring
57	712A-5	Take-up Pressure Spring
58	712A-6	Pressure Roller Spring
59	711A-209	Idler Stop Plate
60	611-50313	#5-40 x 3/16 R.H.M.S.
61	964A-129	Take-up Adjusting Lever Assembly
62	613-60496	#6-32 x 1/4 Socket Hd. M.S.
63	617-6094	#6 Int. Tooth Lockwasher
64	964A-291	Tie Bar Assembly
65	964A-336	Control Spring Plate Assembly
66	764A-18	Spacer
67	714A-530	Speed Change Shaft & Arm Assembly
68	619A-20	.313 "E" Ring
69	714A-336	Speed Change Shaft
70	711A-343	Speed Change Idler Channel
71	617-8114	#8 Int. Tooth Lockwasher
72	616-7209	.63 x .31 x .01 Clock Steel Washer
73	614-8114	#8-32 Hex. Nut
74		#8-32 x 3/8 Allen Hd. Set Screw
75	964C-60	Left Brake Arm Assembly
75A	881A-52	Brake Cork Pad
76	964A-267	Flywheel & Capstan Assembly
77	611-81664	#8-32 x 1 Hex. Hd. M.S.
77A	611-81664	#8-32 x 1 Hex. Hd. M.S.
77B	611-81664	#8-32 x 1 Hex. Hd. M.S.
78	614-8114	#8-32 Hex. Nut.
78A	614-8114	#8-32 Hex. Nut.
78B	614-8114	#8-32 Hex. Nut.
79	615-1124	#10-32 Elastic Stop Nut
80	712A-60	Compression Spring
81	611-80454	#8-32 x 1/4 B.H.M.S. (Not used in some models)
82	742B-1	Brake Pivot Spring (Not used in some models)
83	964C-59	Right Brake Arm Assembly
83A	881A-52	Brake Cork Pad
84	871A-23	Flywheel Washer, Felt
85	619A-20	.313 "E" Ring
86	616-7209	.63 x .31 x .01 Clock Steel Washer
87	714A-478	Equalizer Spacer
88	964B-19	Equalizer Bar & Bearing Assembly
89	714A-463	Feed Reel Spindle
90	714A-183	Equalizer Pivot Stud
91	712A-79	Idler Spring
92	711A-346	Idler Spring Clip
93	714A-462	Take-up Reel Spindle
94	964A-130	Idler Wheel
95	964A-139	Idler Bracket Sub Assembly
96	613-80306	#8-32 x 3/16 Allen Hd. Set Screw
97	899A-3	Take-up Belt, .3125 x 12.625
98	964A-91	Take-Up Pulley Assembly
99	714A-167	Motor Pulley (60 Cycle)
	714-174	Motor Pulley (50 Cycle)
100	714A-171	Belt Pulley
101	899A-2	Feed Belt, .3125 x 17.25
102	714A-491	Rewind Pulley
103	529A-16	Flexible Shaft (Models NL-2 & NL-3)
104	835A-6	Cable Clamp (Models NL-2 & NL-3)
105	711A-597	Cable Clamp Support Bracket (Models NL-2 & NL-3)
106	616A-9209	.377 x .625 x .01 Clock Steel Washer
107	964B-20	Motor Support Plate Assembly
	711B-75	Motor Support Plate
108	611-10454	#10-32 x 1/4 B.H.M.S.
109	616-1240	.203 x .75 x .047 Steel Washer
110	711A-649	Motor Plate
111	367B-8	Alliance Motor
	367B-6	General Industries Motor
112	717A-20	Motor Fan with Set Screw
	964A-282	Motor Fan & Grommet Assembly
113	367B-15	Fasco Motor
	367B-12	Universal Motor